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ABSTRACT

The purpose of this study is to interpret the recent evolution of graduate education within the context of a larger, interdependent system. Graduate education is now in midpassage, suspended between the euphoria of the past and the uncertainties of the future. The essay's chapters attempt to illuminate the sources of past growth, and by implication, the prospects for the future. Chapter 2 examines the broader social role of, and concern for, graduate education, focusing on rationales for subsidization. Chapter 3 turns to the recent history of graduate education, relating the external environment to the internal structure of the university. This analysis is extended to an assessment of future possibilities in Chapter 4. Chapter 5 considers the implications of the analysis with respect to public policy and to the financial support of graduate education. (Author/PG)

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An Economic Perspective on the Evolution of Graduate Education

STEPHEN P. DRESCH

A Technical Report presented to the

NATIONAL BOARD ON GRADUATE EDUCATION

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
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Foreword

The National Board on Graduate Education (NBGE) was established in 1971 by the Conference Board of Associated Research Councils* to provide a means for a thorough analysis of graduate education today and of its relation to American society in the future. In partial fulfillment of that task, three NBGE reports with recommendations have been published to date,† and further Board reports are planned.

In addition to the NBGE reports, several authored reports have been commissioned by the Board to be published in a separate technical report series. One of the purposes of the technical reports is to provide additional information to NBGE which, in some instances, may undergird NBGE policy recommendations. This essay, "An Economic Perspective on the Evolution of Graduate Education," by Stephen P. Dresch of Yale University is the first publication in that series.

The present essay began as an analysis of selected issues bearing on graduate student financial support, but the scope was broadened by the author's development of a theoretical economic model that he employs to explain the growth of graduate education since World War II. The conceptual framework, which involves the economic interplay of graduate education with research and undergraduate education, is also used to project

* Composed of the American Council on Education, the Social Science Research Council, the American Council of Learned Societies, and the National Research Council.

† *Graduate Education: Purposes, Problems, and Potential; Doctorate Manpower Forecasts and Policy;* and *Federal Policy Alternatives Toward Graduate Education.*

alternative patterns for the evolution of graduate education in the 1970's and 1980's. The implications of this theoretical model for graduate student support are also explored.

The study was financed in part by general support funds provided to NBGE from the Carnegie Corporation of New York and The Andrew W. Mellon Foundation. The views expressed in the essay are those of the author and do not necessarily reflect the views of the Carnegie Corporation, The Andrew W. Mellon Foundation, the Conference Board of Associated Research Councils, or the NBGE.

We believe readers will find the essay thought-provoking and a valuable contribution to the theoretical and analytical literature on higher education.

David D. Henry, Chairman
National Board on Graduate Education

March 1974

Preface

Various drafts of this paper have circulated, and I must admit to a degree of pleasant surprise at the level and diversity of the reaction the drafts have evoked. While not invariably favorable nor in agreement with the theses presented, the response has clearly not been one of indifference. However, the nature of the response also suggests a need for a setting of the stage, an explanation of the intentions and limitations of the effort. This preface is designed as an *ex ante* response to several of the reactions that can be anticipated.

UNDERSTANDING VERSUS ADVOCACY: PROCESS AND REALITY IN GRADUATE EDUCATION

My general assignment was to assess, in light of recent experience, the desirability of alternative policies for the support of graduate education in the arts and sciences and, more specifically, for the support of graduate students in these fields. I was, of course, aware of the current decline in the number of students supported by federal fellowships. This trend has understandably and justifiably led to a counteroffensive from the academic community.

In this context, the issue in the design of this essay was whether it would serve primarily a political function, as a contribution to the academic arsenal arrayed against the philistines, or the positive (as opposed to normative)

function of attempting to illuminate the relationship of graduate education to its evolving social context.

Having personally benefited from the social support of graduate education, I would have found it very easy to clothe in quasi-scientific terms a tearing of hair and gnashing of teeth over observed tendencies. Ultimately, however, two considerations led to the choice of an alternate path. First, intellectual curiosity intruded. When we overcome the blindered conception of the late 1950's and the 1960's as the norm in graduate education, the identification of the factors which differentiate this period becomes compelling.

If this question is seriously addressed, it is quite clear that indeed there did exist a constellation of social (demographic and technological) circumstances which constituted a hothouse environment for the growth of graduate education. Thus, the second reason for attempting more than simply another assault on the battlements was the grudging recognition that even the case *for* graduate education might be better served through increased understanding of the relationship of graduate education to broader social processes. Ultimately, I would argue, enlightened self-interest, based on the perception of fundamental processes as well as temporary realities, will be more effective than an unenlightened effort to maintain a status quo in fundamental contradiction with the broader social context.

An attempt at understanding is not without its dangers. Particularly in a case such as this where the stakes are high, at least for some of us, the potential costs of misunderstanding weigh heavily. I can only express the hope that the following discussion will be interpreted with the qualifications appropriate to a preliminary effort designed to stimulate thinking and increase understanding rather than to present a closed case.

POSITIVE VERSUS NEGATIVE IMPLICATIONS FOR POLICY

It seems appropriate here to comment on the nature of the policy implications that can be drawn from the analysis. Several of my colleagues have attempted to identify explicitly those public and institutional polices consistent with the analysis. Others have objected that the essay, though interesting, leaves the reader finally uncertain concerning its specific implications. Indicative of the importance we attach to concrete policy proposals, even I at one point found the paper lacking in this regard and searched for *ad hoc* policy "conclusions" which might be appended. While the attempt to develop a precise list of policies for graduate education is unexceptionable, these responses miss what I now regard to be the essential contribution of this particular discussion.

First, I think the paper must be viewed as contributing to the development of the basis—the conceptual comprehension of the important factors influencing graduate education—required for the elaboration of desirable and effective policies. Its contribution is only partial—limited more-or-less to the perspectives of economics—and preliminary, while positive policy prescriptions will develop only from broad and continuing efforts to comprehend the nature and process of graduate education. Second, policy implications may themselves be either positive or negative, and the most obvious initial implications of the analysis appear to be negative. In the interest of both graduate education and the broader society, the most desirable public policy may very well be a non-policy. Graduate education must be viewed as an instrument, a means to more general social goals. Its effectiveness in this intermediary role may well be improved by forcing it to respond to fundamental changes in the social environment rather than by protecting it from these changes by means of artificial barriers to adaptation. In a dynamic environment it may be better to encourage diversity and mutation than to strive to maintain and achieve a precast ideal.

ACKNOWLEDGMENTS

This study was initially undertaken at the request of the National Board on Graduate Education. The scope of the study was developed through preliminary consultation with David Breneman, Staff Director of the Board and John Perry Miller, former Director of the Institution for Social and Policy Studies, Yale University, and a member of the Board. Both of these individuals have continued to provide intellectual support and constructive criticism. The analysis has also benefited greatly from the intensive study of an earlier draft by a review committee consisting of John D. Millett, Vice President and Director, Management Division of the Academy for Educational Development; Roger Bolton, Professor of Economics at Williams College; and Donald Taylor, Dean of the Graduate School at Yale University, in addition to Mr. Breneman and Professor Miller. I would also acknowledge the constructive criticisms of Richard R. Nelson and James Tobin, Professors of Economics at Yale, of Joseph Ben-David, Professor of Sociology at the University of Chicago and of Robert Strotz, President of Northwestern University. Louis Silversin of Yale and James Hosek, then of the National Bureau of Economic Research and now associated with the Rand Corporation, have read and reread the various drafts and have contributed greatly to the substance as well as the form of the discussion. Without the dedicated efforts of Wendy Graves and Nellie Zorc this manuscript never would have emerged intact.

In addition to the National Board on Graduate Education, financial support for various phases of the continually expanding study has been provided by Yale University's program of Research in the Economics of Higher Education, established under a grant from the Alfred P. Sloan Foundation. It should be noted that this study does not necessarily reflect the positions of any of the forementioned organizations nor of the National Bureau of Economic Research.

Stephen P. Dresch

March 1974

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Evidently, we must cease to think of [progress] as by nature smooth and harmonious in the sense that rough passage and disharmonies present phenomena foreign to its mechanism and require special explanations by facts not embodied in its pure model. On the contrary, we must recognize that evolution is lopsided, discontinuous, disharmonious by nature—that the disharmony is the very *modus operandi* of the factors of progress.

JOSEPH A. SCHUMPETER
Business Cycles

1 Graduate Education in Midpassage

Overshadowed by the more general, but also more acute, turmoils—financial, political, and academic—that have afflicted higher education over the past five years, graduate education has suffered from a quiet, progressively deepening trauma. The anxiety and even desperation with which those involved in graduate education view the contemporary world is graphic evidence of the human capacity to convert any situation, no matter how unique or peculiar, into the "normal" state of affairs. To give an analogy: in a society that has experienced no secular increases in income, people are not troubled by stagnation; but in a society where incomes have increased, though perhaps for only a brief period, people expect this trend to continue and are alarmed even by a decline in the *rate* of increase. As in societies, depressions in graduate education very quickly become transformed into permanent states of "secular stagnation." The prophets of perennial progress precede in time, but do not exceed in conviction, the prophets of incipient doom.

In graduate education, a peculiar confluence of events in the late 1950's and early 1960's served to inaugurate a fleeting "Golden Age":

- enrollment grew at record rates;
- faculty salaries and nonmonetary perquisites (research facilities, assistance, etc.) rapidly improved;
- financial opportunities for students expanded dramatically, virtually eliminating the temporary vow of poverty required for entrance into the ranks of the highly educated; and

- the social significance of the educated elite became much greater as a result of increased mobility between academia and the loci of political power.

In brief, graduate education, previously serving primarily as a purveyor of educated manpower to institutions of higher education, was transformed into a major industry in its own right. Had such a transformation not taken place, current concern for graduate education would be far less intense.

To comprehend the present condition of graduate education and to identify and evaluate the alternatives available to public policy, one must understand the environment within which the sector operates and the factors which explain how the structure and role of the graduate education system evolved. It is insufficient simply to document the recent deterioration in the financial circumstances of graduate education. Clearly, the sector has shifted from rapid expansion, with all of its attendant benefits, to relative contraction. This change in circumstances is not, however, necessarily inappropriate or socially undesirable. The increasingly stringent constraints imposed on graduate faculties and students will obviously be painful, but decisions regarding the social support of graduate education must be based on more than the self-interest of its direct beneficiaries.

The fundamental thesis of this essay is that graduate education, as we know it, is the result of complex interactions between the macrosocial context, on the one hand, and the microcontext of the university and the broader higher education sector, on the other. Neither alone is sufficient to explain the historical processes of expansion and contraction. Comprehension of the macrosocial dimension requires a perspective incorporating the fundamental demographic, technological, and economic elements that define the social functions of knowledge and expertise. Thus, the rapid growth of the graduate education sector over the last two decades had its origins in the unique coincidence of (*a*) a temporary series of disruptions in the trend of population growth, (*b*) a probably cyclical peaking in the rate of technological advance, or at least in rates of research and development spending, and (*c*) a restructuring of economic relationships, which was primarily technologically induced. These three interwoven elements provided an external environment which stimulated the upsurge in the social demand for graduate education.

The responses of graduate education to this increase in demand, however, can be understood only if we consider the internal structure of the university, specifically, the interrelationships between graduate education, undergraduate education, and research. The capacity of the graduate education system to respond to changing social demands has been facilitated by the dual role of graduate education as both an output of the university and an input into other university functions.

The purpose of this study is to interpret the recent evolution of graduate education within the context of this larger, interdependent system. The prospects for graduate education in the intermediate future have obviously dimmed during the last few years. The exuberant growth characteristic of the past has been succeeded by a grudging retrenchment. How the system should respond to this change in circumstances depends on the precise sources of the current recession. If the present constraints on the system are simply temporary, then radical responses may prove to be unduly extreme and costly. Conversely, if these constraints reflect fundamental changes in the environment, then the search for temporary solutions will ultimately prove futile, and a basic restructuring of the forms and processes of graduate education will be unavoidable.

The qualified conclusion of the analysis is that the current stresses in graduate education result not from temporary shocks but from fundamental changes in the environment that will persist into the future. The graduate education sector has, however, the capacity to adapt effectively to these changes. New opportunities have been created which, while they may not perpetuate the Golden Age, can at least serve to maintain a viable system of graduate education.

Thus, graduate education is now in midpassage, suspended between the euphoria of the past and the uncertainties of the future. The following chapters attempt to illuminate the sources of past growth, and, by implication, the prospects for the future. Chapter 2 examines the broader social role of, and concern for, graduate education, focusing on rationales for subsidization. Chapter 3 turns to the recent history of graduate education, relating the external environment to the internal structure of the university. This analysis is extended to an assessment of future possibilities in Chapter 4. Chapter 5 considers the implications of the analysis with respect to public policy and to the financial support of graduate education.

2 Rationales for Subsidization of Graduate Education

The extent to which graduate training should be subsidized is a fundamental issue in the study of financial support for graduate education. But any discussion of this issue quickly becomes encumbered by a number of very difficult and different—though intertwined—questions, ranging from how one should determine "cost" to who should bear the burden of subsidy support. Many of these questions will be discussed in later chapters. Our concern here is more restricted, focusing specifically on *appropriate criteria* for approaching the subsidization issue: On what grounds have proponents advocated public subsidies to graduate education? How relevant are these arguments to the issue of financial support for graduate education? Only after these questions have been clarified can we meaningfully consider such issues as how large a subsidy should be provided, in what form, and for what purpose; furthermore, the specific institutional context within which graduate education is pursued must then be taken into account.

At the outset, the term *subsidy* should be adequately delimited. To do so requires a brief overview of the next chapter, which examines graduate education within the context of the university. The university is a "multiproduct firm," with graduate education, undergraduate education and research among its products. Graduate education, however, is exceptional among these activities. It is both an output and an input. One consequence of this dual nature is the difficulty of identifying the "cost" of graduate education. For present purposes, the cost to the university of providing graduate education can be defined as the increase in the total cost of university operations that results from the enrollment of one additional graduate student,

holding undergraduate education and research activities at their previous level.[1] The cost is computed after taking into account what the graduate student contributes to other university activities, e.g., as an assistant in teaching or research. Cost, in this sense, may differ radically from simplistic conceptions of "full cost," as defined, for example, by the bookkeeping costs of graduate faculty and laboratory facilities, a measure that ignores the direct and indirect contributions of graduate students to other university operations.

The point, very simply, is that *subsidization* from outside the system must be distinguished from any *compensation* (lowered net cost) justified by the intrauniversity benefits of graduate training activities. At a number of points in the following discussion, reference is made to the *social* or *external* benefits flowing from graduate education or from the graduate-educated. These should be carefully differentiated from the *intrauniversity* benefits, which—though they indeed warrant recognition in determining what price the graduate student should pay—involve the university's compensation to the student for services rendered, services that directly benefit the university itself rather than society. In discussing subsidization from extrauniversity sources, the appropriate focus is the distribution of the incremental (or net) cost, as defined above, after taking into account intrauniversity benefits. To what extent should this net cost be borne by society rather than by the student?

The issue of subsidizing graduate education *per se* should also be distinguished from the issue of subsidizing postsecondary institutions. As the next chapter points out, although economic analysis may call into question many of the rationales for directly subsidizing graduate students, subsidies for institutions may well be necessary or desirable, even if prices paid by students correspond to net incremental cost. The issue of direct subsidies to graduate students can be separated analytically from the issue of subsidies to higher educational institutions.

Advocates of subsidy support for graduate education have generally justified their position on one or more of four arguments:

1. Support for graduate education is a necessary, albeit implicit, subsidy to other activities of social concern—in particular to undergraduate educa-

[1] The following schema for discussing costs and subsidization may prove useful: The *social cost* of graduate training comprises (*a*) the incremental cost to the university, and (*b*) the earnings foregone by the student as a result of his pursuance of graduate education. *Tuition* is that part of the incremental cost to the institution not met by public subsidization or other sources and thus, with exceptions, borne by the student. Tuition may be negative; i.e., the student may be compensated for some or all of his foregone earnings either if subsidization exceeds incremental institutional cost or if this cost is itself negative because of the benefits that the university derives from the presence of the student. The *total cost to the student* is, then, (a) tuition either positive or negative and (*b*) foregone earnings.

tion and research—and it is the social value of these activities which justifies graduate support.

2. Subsidies to graduate education are an effective means of controlling (or augmenting) the demand for graduate education; hence they ensure that there will be adequate supplies of appropriately trained persons.

3. Support for graduate education enhances the individual's social mobility; without such support, existing class rigidities and undesirable patterns of income distribution would be perpetuated.

4. Social benefits (benefits in excess of those to the individual) flow from graduate education and justify public support. To differentiate this argument from the first: These social benefits are not a function of any specific activities of persons with graduate education, and subsidies are not implicitly directed at particular sectors of the economy.

The remainder of this chapter is divided into four sections, based on the four rationales just summarized. Each will be discussed and criticized in turn. A final section is then devoted to a discussion of this critique.

IMPLICIT SUBSIDIZATION OF UNDERGRADUATE EDUCATION AND RESEARCH

The most common rationale—that of "implicit subsidy"—justifies support of graduate education on the grounds that it has desirable consequences for other, directly favored activities, notably, undergraduate education and research. In simplest terms, if graduate education is highly subsidized, then the relative wages of educated manpower will be significantly lowered. Undergraduate education and research in particular will benefit because the wages of persons working in these sectors represent a large fraction of their total cost. The result should be an increase in the services supplied by these sectors. Specifically, it is argued that this increase results either from the larger quantity of educated manpower available at any wage level, or more subtly, from the effect of subsidization on the career choices of the highly educated—in particular, on the choice between teaching and research, on the one hand, and alternative careers, on the other.

The most obvious difficulty with the first argument—"supply-augmentation"—is that a substantial share of the benefits of the graduate subsidization may accrue to "nonpreferred" users of the graduate-trained or to the graduate-educated themselves. If the primary effect of educational subsidies is to increase the total supply of highly educated manpower, thus reducing their wages relative to those of the less educated or to those whose educations are less highly subsidized, e.g., certain of the professionally educated, then all users of highly educated labor will benefit. Not only will the appar-

ent relative cost of undergraduate education or research be reduced, but also such reductions will occur for all activities that employ the graduate-educated.

The significance of this "dispersal of benefits" is, of course, a quantitative question. If subsidies do indeed increase the demand for graduate education, and if the vast majority of Ph.D's enter academia, then it can reasonably be argued that the higher education sector reaps most of the benefits of graduate subsidization. Thus, the career dispositions of Ph.D.'s provide a rough indicator of the degree to which these assumptions hold true.

In the early part of the century, higher education was the predominant beneficiary of support to graduate education in that, in 1900, between 70 and 80 percent of all Ph.D.'s were employed in academic institutions. But by 1958, this ratio had fallen to 60 percent.[2] Since 1958, the proportion of Ph.D.'s in academia has probably declined even further, as is evidenced by the finding that, from 1954 to 1964, the figure for *new* Ph.D.'s entering college teaching (first employment) has fluctuated between 45 and 50 percent,[3] a proportion significantly smaller than that of all Ph.D.'s. Of course, it is possible that many new Ph.D.'s who do not immediately take jobs in educational institutions may eventually do so. The little evidence that exists on this score suggests, however, that the gross flow of Ph.D.'s into academia from other sectors is approximately cancelled by the flow of established Ph.D.'s out of academia.[4]

These data on Ph.D. employment may well induce some skepticism toward the assertion that the broader higher education sector captures most of the benefits of graduate subsidization, and this skepticism is only strengthened when we look at individual field or at less-than-Ph.D.-level graduate training. To take the first point: As substantial evidence indicates, fields vary widely in the proportion of their Ph.D.'s who enter academic employment. Of the 1962–1963 doctorates in 15 fields, the proportion taking academic jobs ranged from a high of 89 percent in English to a low of 23 percent in chemistry, with a fairly continuous distribution of fields between these extremes (see Table 1). In general, the humanities ranked relatively high, the sciences very low. Thus, the benefit to higher education of graduate support varies markedly over different fields.

Evidence is much more sparse concerning graduate students who do not complete the Ph.D. Of all newly hired faculty, at least 40 percent have the Ph.D., and this group represents less than half of all new Ph.D.'s. Since 70 to 80 percent of the students who enter graduate school do not complete

[2] Seymour E. Harris, *A Statistical Portrait of Higher Education* (New York: McGraw-Hill, 1972), p. 496.

[3] *Ibid.*, p. 495.

[4] Allan M. Cartter, "A New Look at the Supply of College Teachers," *Educational Record* 46 (Summer 1965), pp. 267–277.

TABLE 1 Percentage of Ph.D.'s Entering College Teaching, by Field 1962–1963 and 1963–1964

Field	Percentage
English	88.6
History	87.6
Foreign languages	87.3
Political science	79.0
Sociology	76.6
Music	75.6
Mathematics	66.4
Economics	65.9
Education (Ph.D. and Ed.D.)	48.5
Biological sciences	40.9
Psychology	37.2
Engineering	36.0
Agriculture	33.5
Physics	28.7
Chemistry	22.8
Totals 1962-63, 1963-64	48.4
1960-61, 1961-62	46.7
1958-59, 1959-60	45.6
1956-57, 1957-58	44.5
1954-55, 1955-56	45.2

SOURCE: Harris (p. 495), from U.S. House of Representatives, Committee on Government Operations, *Conflict between the Federal Research Programs and the Nation's Goals for Higher Education*, subcommittee hearings, June 1965, p. 91.

the Ph.D., most of those lost by attrition must enter nonacademic sectors.[5]

In short, subsidization of graduate education as an implicit means of supporting undergraduate education is a weak, and progressively weakening, device. Since over 50 percent of basic research takes place in colleges and universities, the same general observation seems applicable to graduate support as an indirect method of subsidizing research.[6] Thus, if the underlying motive for subsidizing graduate education is actually to subsidize undergraduate education and research, a more direct route—one that avoided the dispersal of benefits inherent in graduate education support—would be more efficient.

[5] Harris, *Higher Education*, p. 512. If the 40 percent of new faculty members who have the Ph.D. constitute one-half of the 20 percent of all entering graduate students who receive the Ph.D., then the 60 percent of new faculty members without the Ph.D. must constitute no more than 15 percent of all entering graduate students, or less than 20 percent of those lost by attrition.

[6] Because the graduate-trained are used to a significantly lower degree in applied and developmental research, subsidies to graduate education are a weak and circuitous means of supporting these activities as well. In addition, at this level, greater importance attaches to determining the specific tasks which are subsidized, reducing further the desirability of indirect means of infusing support.

Of course, if the object of graduate subsidization is not to augment the total supply of the graduate-educated but to alter the distribution of the available pool between academic and nonacademic employment, then the preceding discussion may appear irrelevant. Those who propound this second argument seem to have the following view of the relation between subsidization and career choice:

If expensive and time-consuming graduate training were unsubsidized, then those undertaking it would presumably be forced to make heavy financial sacrifices, e.g., to borrow heavily, to forego earnings. To meet these deferred, posteducational financial commitments, occupational choices, it is argued, would be skewed toward the more financially remunerative options, thereby reducing the differential between academic and nonacademic salaries. In short, the financial burdens incurred by graduate students would lead former students to place relatively less value on the nonmonetary perquisites of academic employment. In the language of the economist, the demand for nonmonetary benefits of employment is income elastic. The relevant measure of income here is money income net of the repayment of educational loans. In other words, the higher a person's potential disposable income, the more willing he is to trade some part of that income for other job-related benefits.

Although the relation between occupational choice and such factors as debts incurred during graduate training could be identified through empirical research, unfortunately, little information exists to illuminate this relation. But even if it were shown that being in debt affects occupational choice, the case for subsidization of graduate education would not be proved. Unless such subsidies could be targeted on those persons whose occupational choices would be altered, a substantial share of the benefits of subsidization would flow to those whose decision to enter or not enter academic employment would not be influenced by these financial considerations in any event. Thus, a narrowly efficient indirect subsidy system justified on these grounds would provide a subsidy not to graduate education *per se* but rather to career choice.[7]

In short, general support of graduate education is not an effective means of indirectly subsidizing such activities as undergraduate education and research. The subsidy is dispersed as more and more graduate students pursue nonacademic, nonresearch careers.

But even were this not the case, a strong argument could be made against this mode of indirect subsidy, on the grounds that such a mechanism could result in serious distortions *within* the indirectly aided higher education and

[7] Such a system would be only narrowly efficient in the sense that, if looked at from a broader perspective, it might still be undesirable (as discussed below) even though it maximized the proportion of the graduate-educated entering academia at any salary differential and aggregate subsidy level.

research sectors. Such distortions would result from the mechanism by which these sectors would benefit from graduate subsidization.

Regardless of how the subsidy operates to augment the supply of the graduate-trained to education and research, the ultimate beneficiary activities receive a subsidy, if at all, only in the form of lower wages for these teachers and researchers. In effect, employing institutions view highly trained personnel as involving a lower cost, relative to other inputs, than is actually the case. And to this degree such personnel may be utilized in a socially nonoptimal manner. Specifically, academic institutions may become undesirably intensive users of the most highly credentialed persons, without regard for the social costs of these as opposed to less educated employees. For example, the growing importance of the Ph.D. as a license to teach in an institution of higher education may be partially a response to increases in the subsidization of graduate education.

More serious, perhaps, reliance on this particular mechanism of implicit subsidization may involve an undesirable distribution of the ultimate benefits of the subsidies. That is, under a system in which the Ph.D. is more highly subsidized than the master's degree, the more intensive user of the Ph.D. ultimately receives a greater implicit subsidy than the intensive user of the M.A. or the M.S. In the case of higher education, the undergraduate in an illustrious university receives a greater effective subsidy than his counterparts attending a four-year or a two-year college. Any explicit subsidy scheme with such a provision would probably not be very popular politically once its effects were understood.[8] Similarly, those research activities which draw most heavily on the highly trained receive the greatest effective subsidy. In a period that emphasizes the application of established knowledge to new areas of social concern—natural resources, the environment, transportation —this distribution of public subsidies to research may not be the most preferable. The fundamental problem here, however, may not be the *level* of training but the *nature* of that training.

If it is desirable to subsidize undergraduate education and research, it is probably also desirable to decide explicitly which of the various components of these activities will be supported, and to what degree, rather than relying on the employment disposition of "underpriced," highly trained personnel to determine the distribution of the public subsidy. If implicit support of these other activities has been a basis for subsidizing graduate education, direct subsidization would offer a more effective and less costly means of achieving the basic objectives. And, as was mentioned previously, a shift from indirect to direct subsidization should also lead to more efficient use of highly trained labor. It might be pointed out that this conclusion is not lim-

[8] On the other hand, the existing system of tuition subsidies in public schools also has this "elitist" bias, the subsidy per student being greater in the more prestigious institutions. So the political viability of such a policy may in fact be great.

ited to graduate education; it is applicable to any subsidies or taxes designed to influence particular types of behavior.

MANPOWER CONSIDERATIONS AND LABOR SUPPLY ADJUSTMENT

A recurrent theme in any discussion of financial support for graduate education is the necessity to mediate between individual career choices and national manpower needs. Without effective control of educational options, it is argued, some manpower needs may be unfulfilled while supplies of persons with other skills may be excessive.

Why are labor market considerations thought to carry more weight for the highly educated than for other levels? The answer lies in the long gestation period and in the relatively narrow specificity of graduate-level investments in human capital. In contrast to those people in most skilled trades, and certainly to those in occupations such as factory worker, the person who chooses a career requiring graduate training makes a choice that precedes by a number of years his full-fledged participation in the labor force. During the protracted period of graduate education, market conditions may change radically, and in ways unanticipated at the time that the educational decision was made. Thus, the decision to pursue a career requiring graduate education entails significant risks.

These risks are particularly great in that graduate training results in considerable specificity of skills and knowledge. At the baccalaureate level, most major fields allow a wide range of career options. The traditional undergraduate curriculum is relatively unspecialized, providing a broad general education.[9] In consequence, although undergraduate study is also protracted, the risks are fewer. At the graduate level, the ease with which career choices can be adapted to changing market conditions declines precipitously.

Obviously, even the highly educated do, in fact, adapt their career choices to changing market conditions. The point is that such adaptations may well involve significant "capital losses" for the graduate-educated person. If his graduate training does not contribute significantly to his new vocation, then he has, in effect, suffered a capital loss on his investment in that training.

Of course, the *ability* of a person with a graduate education to adapt his career choices may be greater as a result of that education, in which case his educational investment is not lost, even if his specific skills and knowl-

[9] The reference here is to a liberal arts baccalaureate education. But even in more specialized vocational–professional programs, a wide range of options is often available, at least in those occupations that are not industry-specific, e.g., accounting. Perhaps more important, the specialized investment is significantly lower; the risk that a particular educational program will prove to be useless does not entail such substantial costs.

edge are not used on the job. Enhanced adaptability is, however, a frail argument for social support of higher education, particularly at the graduate level. First, that individuals with graduate training adapt more quickly to changing career opportunities than do those without such training need not imply that graduate education *per se* increases adaptability. The graduate-educated may be distinguished by other characteristics—e.g., intellectual or psychological attributes—that make them more adaptable but that are not attributable to their postbaccalaureate training. More perversely, if employers use educational attainment as a screening device, then graduate training may well contribute to the individual's adaptability only at the expense of those with less education.[10]

Whatever the relation between graduate education and career flexibility, the need for an individual to change his career choice implies a discrepancy between his expectations at the time he made the decision to enter graduate school and actual labor market conditions after that training is completed. And it is a fear about this discrepancy that will deter some persons from pursuing a career that requires protracted and specialized training.

Reinforcing the greater risk at the postbaccalaureate level is a corresponding increase in the effective cost of the educational investment. The earnings foregone in favor of undergraduate education are not exceptionally great, particularly when the consumption value of undergraduate life and the high unemployment rates of recent high school graduates are taken into account. But the further a person progresses in education, the greater this opportunity cost of additional education becomes. Thus, the increasing riskiness of the return and the increasing (and increasingly certain) costs may dissuade potential students from pursuing graduate education.

The picture painted so far may be unduly bleak. First, the decision to enter graduate school is not irreversible, as evidence on "voluntary" attrition demonstrates. Second, although education-related career options become progressively more constrained, even the Ph.D. has a range of education-related alternatives (e.g., academic versus nonacademic employment) permitting him some degree of adaptation to changing market conditions. But from a social point of view it is possible that, in the absence of some form of compensatory action, risk-averse students may underinvest in education, particularly at the postbaccalaureate level.

Such considerations lie behind many proposals for public subsidization of graduate education. In the absence of any effective means by which graduate students can insure against the risks of changing labor market conditions, these subsidies would raise the perceived net benefit by reducing the perceived cost.

[10] The use of graduate education as a screening device can be criticized either because it is ineffective (i.e., arbitrary and unrelated to the individual's probable productivity) or because it is unnecessarily expensive, and less costly but equally (or more) effective screens could be devised.

As a desirable alternative to subsidies justified on these grounds, however, a mechanism might be created whereby the student could insure at least partially against the risks associated with graduate education. And while the aggregate flow of people into graduate education might be improved by appropriately designed subsidization, individuals could still benefit from an effective device for risk pooling.

Two basic types of educational–career risk can be identified: *individual* and *market*. The latter, emphasized in the preceding discussion, derives from the difficulty of knowing in advance—i.e., when educational decisions are made—what the future social demands for particular types of trained persons will be. To some degree, these risks may not be insurable, in the sense that losses to different individuals may be unpredictable but highly correlated. If, for example, all graduate students in economics were placed in a risk pool, aggregate market risks could not be insured against, since all members of the pool would suffer the same fate eventually: a decline in the demand for economists.[11] If, however, the risk pool is progressively enlarged, to include first all the social sciences, then all graduate fields, then this correlation of outcomes is progressively reduced.

Obviously, aggregate market risk never entirely disappears. Should the younger generation "green" so radically that college enrollments drop sharply and should the older generation suddenly decide that the advancement of knowledge through research has little value, then outcomes in all fields might fall far short of original expectations. This possibility suggests that any desirable insurance scheme should pool these risks not only among students but also between students and the rest of society. Society as well as the student benefits from the reduction in risk and the encouragement of levels of enrollment that, from the vantage point of the present—and probably of the future—are desirable.[12]

The second type of educational–career risk, individual risk, derives from the student's inability to assess accurately his likelihood of success in a particular field. A number of factors enter into the graduate educational transformation (the nature of the educational experience), and as graduate attrition rates graphically testify, the student is not always aware of these beforehand. Even after 16 years of pregraduate education, uncertainties remain. The potential student may find it particularly difficult to assess this risk because, as will be discussed in the next chapter, the nature of the educational process itself alters markedly in the transition from pre- to post-baccalaureate education; the characteristics and capabilities that led to success in college may not be as significant in graduate school. Many graduate students, uncertain about themselves, must perceive such risks.

[11] Thus, an insurance company charging premiums on the basis of a currently perceived probability that the demand for economists will decline would either make a large profit (if the decline did not occur) or incur large losses (if it did).

[12] This is, in effect, an argument for what might be called a *contingent subsidy*.

In general, adequate devices for insuring against both individual and market risk would be superior to compensatory subsidization. In particular, information needs for the formulation of policy would be fewer, and the risk of seriously distorting market performance would be less. The need for subsidization would be further reduced if, concomitantly, the terms on which students could gain access to capital markets were improved. The failure of the capital market to provide suitable sources of credit for educational investments only aggravates students' hesitations about pursuing graduate education. Conventional sources of capital, in the absence of a governmental guarantee, are almost totally foreclosed to potential students, on the grounds that they are likely to default. Moreover, students—anxious over the relative risks involved in an investment in graduate education—find the burden of conventional loan repayment potentially onerous, even when this form of credit is available to them. Thus, credit could be rendered more freely available and the unpalatability of debt could be greatly reduced if some form of insurance could be provided against the risk that the student will experience a lower-than-expected lifetime income.

Because capital market imperfections represent a major source of demand distortion in their own right, the potential implications of such income insurance for credit availability represent a significant domain within which appropriate public policies could substantially improve the financial status of graduate students and alter the demand for graduate education. Specific means for achieving this goal are discussed in the Appendix at the conclusion of this study.

The foregoing discussion may seem peripheral to popular notions about the manpower issues related to graduate education. Advocates of intrusion into the graduate education process have usually predicated their arguments on perceptions of much more fundamental market failures than simple uninsurable risk and capital market imperfection. These advocates fail to recognize that potential students may have available to them mechanisms whereby information about career opportunities, market shortages and surpluses is communicated to them and that they can thus make rational career choices. Rather, students are seen as responding only to very immediate cues—e.g., the availability of fellowships—and as having no concept of longer-run possibilities. If this view were accurate, a system relying upon subsidization and rationing might well be required to draw appropriate numbers of people into the right fields.

As Richard Freeman has persuasively argued,[13] though financial support to graduate students *does* play a significant role in influencing career choices, it is not the only operating factor; employment opportunities and expected

[13] Richard B. Freeman, *The Market for College Trained Manpower: A Study in the Economics of Career Choice* (Cambridge, Mass.: Harvard University Press, 1971), pp. 107–110.

incomes also play predominant roles. Freeman has found convincing evidence that the "market" for graduate-educated manpower does work and that student support programs operate only within and through this market system.

If this conclusion is true, what justifies intrusion into the functioning of the market? Two possible arguments for such mediation can be suggested: First, the free market outcome may be considered undesirable from a social point of view and thus in need of control. Second, the market solution is not perfect and instantaneous but involves a number of lags in the adjustment process; thus, various policies designed to improve market performance may be called for. If we admit that a market does function for highly educated persons—that the decisions of students and employers take place in a market context—then the two arguments just mentioned are the primary grounds for intrusion.[14] However, the first is not truly a manpower or labor supply argument but must rest either on implicit subsidy grounds or on a more general claim of social benefits (topics discussed elsewhere in this chapter). Thus, the second argument, improvement of the market adjustment process, is the only true labor market argument for subsidization.

However, actions designed to perfect market performance assume that we know beforehand the characteristics of a desirable market outcome, i.e., of the true market equilibrium. On the basis of historical data, Freeman has shown that the adjustment to new market circumstances is not rapid nor necessarily convergent to a new equilibrium.[15] Thus, if we knew what factors interact to determine the supplies of and the demands for educated labor, we could presumably intervene in the market to avoid some of the costs of prolonged market disequilibrium.

The question is precisely this: Does our present knowledge permit us to guide student choices in desirable directions? Judging from earlier attempts to anticipate labor market conditions, as well as from Freeman's work (both its positive contributions and its limitations), I would suggest that it does not. Projections of manpower needs and probable supplies have been so superficial and unsubstantiated and our current understanding is so limited that any attempt to channel the flow of students into particular fields (or into graduate education as a whole) has as good a chance of worsening as of improving the market outcome.

[14] Donald W. Taylor has convinced me that a number of institutional (political, organizational) arguments for intrusion can be made. Specifically, to limit the extent of interfield wage differentials, it might be necessary to give some fields significant fellowship support, thus reducing the wage differential that would otherwise be necessary to induce a given supply of personnel. This is an instance in which the economist's abstract frame of reference may be violated by the existence of institutional constraints, rigidities, and inertias. This issue is discussed further in the final section of this chapter.

[15] Freeman, *College Trained Manpower*, p. 12.

This is not to suggest that we should be indifferent to the workings of the market for highly educated manpower. Given the weaknesses of our understanding, however, we should proceed cautiously. The first step should not be to try to *manipulate* decisions but to *improve the information* available to students as they make educational and career choices. Only if much firmer knowledge than we currently have were available could a defensible case be made for attempting to modify such decisions directly.

One may grant that current knowledge provides an insufficient basis for attempting to influence student decisions and, at the same time, assert that manpower considerations are relevant to graduate education policy. For instance, it has been strongly argued (in the Newman *Report on Graduate Education*,[16] among others) that graduate schools and departments have been so unresponsive to the needs of students and of the labor market that they constitute a major barrier to effective market adjustment and equilibration. If this were true, then even though students make decisions in response to correctly perceived market signals, the failure or inability of the educational system to respond to changing patterns of student demand might still thwart adjustment.

But again, it is difficult to assess the truth of these charges. To be sure, institutions have used rationing and artificial incentives in an attempt to maintain particular patterns of enrollment. The evidence of the 1960's indicates, however, that the distribution of enrollments among fields can change significantly over short spans of time (see Table 2),[17] and Freeman has shown that these changing enrollment patterns were unrelated to initial estimates of available, unused capacity.[18] Though this adjustment process may have been slowed by institutional rigidities, it is important to note that many of these rigidities were attributable to subsidy policies which either misperceived changing manpower needs or left their divination to graduate institutions. In either event, these experiences provide a very weak basis for advocating even firmer institutional controls over the graduate education process.

EQUITY AND EDUCATIONAL OPPORTUNITY

Almost every discussion of educational policy includes a panegyric to equity and equality of opportunity. But all too often these terms are used to justify

[16] U.S. Department of Health, Education and Welfare, *Report on Higher Education: The Federal Role—Graduate Education*. (Washington, D.C.: U.S. Government Printing Office, 1973).

[17] In interpreting the data in Table 2, one should note that the distributions utilize eight broad fields. Were finer distinctions made, greater change over time would be observed.

[18] Freeman, *College Trained Manpower*, p. 135.

TABLE 2 Distribution of Graduate Enrollment over Fields of Study, 1960–1970

	Ratio of 1970 to 1960 Share	Biennial Distributions (%)					
		1960	1962	1964	1966	1968	1970
Mathematical sciences	.79	4.2	4.3	4.4	4.3	3.8	3.3
Physical sciences	.63	9.3	8.6	8.7	7.6	6.8	5.9
Engineering	.72	13.2	13.3	13.1	11.9	10.6	9.5
Biological sciences	.96	6.9	6.9	7.1	7.3	6.8	6.6
Social sciences	1.05	17.6	17.4	18.2	18.4	17.9	18.5
Arts and humanities	1.14	13.2	13.6	14.3	15.8	15.4	15.0
Education	1.09	34.2	34.5	32.2	33.0	35.7	37.3
Broad miscellaneous	2.53	1.5	1.6	2.0	1.8	2.9	3.9
		100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: U.S. Department of Health, Education and Welfare, *The Federal Role–Graduate Education* (Chart 1), based on 1) *A Fact Book on Higher Education* (Washington, D.C.: American Council on Education, First Issue, 1971), pp. 71.38, 71.39; and 2), U.S. Office of Education, *Students Enrolled for Advanced Degrees: Institutional Data* (Washington, D.C.: U.S. Government Printing Office, Volumes for Fall 1966, 1968, 1970).

policies—including large-scale, across-the-board subsidization—that do little to improve overall equity or equality of opportunity.

The empirical basis for the concern with equity is obvious: The probability of a person's entering or completing any level of education is highly correlated with his socioeconomic status. Further, the higher the level of education, the closer the correlation. To assess the desirability of policies explicitly designed to mitigate the consequences of class inequalities, however, we must inquire into the sources of these socioeconomic differences in educational attainment.

The cardinal fact is that the children of the rich have more of everything than do the children of the poor. They consume more throughout the dependent phase of their lives, and eventually they inherit greater wealth. One important characteristic of education is that it represents both current consumption and an investment in human wealth and future consumption. On both counts, we would expect the children of the rich to attain higher levels of education than do the children of the poor. If a person is to inherit wealth from his parents, it is reasonable for him to choose to hold some part of that wealth in the form of human, as opposed to physical or financial, capital, at least if the return to human capital is sufficiently high. Thus, the greater human capital investments of children from higher socioeconomic groups simply parallel their greater wealth.

Beyond this, education has a consumption value in its own right. During the period of postsecondary education it *represents* a life-style that is valued (perhaps as much for the conspicuous consumption of the parents as for the

direct consumption value to the student), and afterward it *contributes* to a life-style that is more than simply the fruit of its material rewards.

In this context, subsidization of education on the basis of parental income can be seen as a *selective redistribution of wealth*. For the economist, wealth represents the present value of a stream of future income (or consumption). Looked at in this way, subsidies to graduate education represent social "gifts" of consumption possibilities. But social gifts to whom? Obviously, not to the person who leaves school before the eighth grade, before high school graduation, or before completing college. Thus, as Table 3 indicates, very few persons from lower socioeconomic levels remain in the educational system long enough to benefit from support for graduate education. Even among the most highly able, the proportion of high school graduates that survive to enter graduate school is almost five times greater (34.6 percent) at the highest socioeconomic quartile than at the lowest (7.4 percent). Ignoring ability, almost 14 percent of high-status high school graduates enter graduate programs, as against only 2 percent of their low-status counter-

TABLE 3 Ability, Socioeconomic Status and Graduate School Entrance [a]

		Socioeconomic Status Quartile			
		1 (high)	2	3	4 (low)
Ability Quintile	1 (high)	34.6	21.0	15.3	7.4
	2	17.0	11.4	5.2	8.0
	3	11.5	6.7	3.6	1.3
	4	6.6	2.0	1.8	0.9
	5 (low)	3.8	0.9	1.0	0.3
Total (by status)		13.6	9.7	5.0	2.2
Hypothetical, ability-equalized total[b]		13.6	12.6	8.3	5.3
Ratio of hypothetical to High-status actual		1.00	0.93	0.61	0.39

[a] Probability that high school graduate will enter graduate school within five years.
[b] Assumes distribution of high school graduates over ability classes is identical for all status groups, equal to that of high-status group.
SOURCE: Robert H. Berls, "Higher Education Opportunity and Achievement in the United States," in *The Economics and Financing of Higher Education in the United States* (Washington, D.C.: U.S. Government Printing Office, 1969), from Tables 2, 14 and 18, based on Project Talent, 5-year follow-up survey.

parts. And even if the ability distribution of low-status high school graduates paralleled that of the high-status group, their overall probability of entering graduate school would rise to only 5 percent.

As the data on college graduates in Table 4 indicate, similar patterns hold true for the *potential* beneficiaries of graduate education. In effect, then, we

TABLE 4 Ability, Socioeconomic Status and College Graduation [a]

		Socioeconomic Status Quartile			
		1 (high)	2	3	4 (low)
Ability Quintile	1 (high)	64.0	41.6	36.5	24.4
	2	40.8	28.0	21.6	16.3
	3	26.7	17.0	10.8	7.6
	4	16.7	7.8	5.9	3.8
	5 (low)	8.2	6.7	3.0	2.3
Total (by status)		42.6	22.7	14.8	7.3
Hypothetical, ability-equalized total[b]		42.6	27.8	22.6	15.7
Ratio of hypothetical to high-status actual		1.00	0.65	0.53	0.37

[a] Probability that high school graduate will graduate from college four years later.
[b] Assumes distribution of high school graduates over ability classes is identical for all status groups, equal to that of high-status group.
SOURCE: Berls, from Tables 2 and 14.

winnow out most of the children of the poor while at the same time we proclaim our commitment to equality by redistributing the wealth to those who will be most affluent: the survivors of the educational gauntlet.

Moreover, most of the benefits may accrue not to the most successful children of the poor but to the more-or-less successful children of the affluent. Resistance to grants based on need is great, particularly in graduate education, where commitment to scholarly excellence abhors the thought of giving special encouragement to the "less able." As a result, the trend, at least through most of the 1960's, was toward grants based on ability, not need. Given the intergenerational form of this contest, the affluent are most likely to take the lion's share of the rewards.

To make the situation even more difficult, the graduate student is no longer considered the "child" of his parents, but an independent adult, although one who may eventually inherit considerable wealth. Thus, even if grants are to be distributed on the basis of need, the definition of "need" becomes clouded, as is evidenced by the efforts of the consortia of graduate schools, in conjunction with the Graduate Record Examinations Board, to develop operational criteria of need.[19] Even with these recent moves toward

[19] Unlike the College Scholarship Service—which has been able to achieve virtual unanimity on the criteria for determining undergraduate financial aid—the Graduate and Professional School Financial Aid Service of the Graduate Record Examination Board has been forced to develop a number of options from which graduate schools and departments can choose to determine financial need. For further details, see James L. Bowman and Dwight H. Horch, *Measuring the Financial Status of Graduate and Professional Students* (Princeton, N.J.: Graduate and Professional School Financial Aid Service (GAPFAS), Educational Testing Service, December 1972).

requiring a demonstration of financial need, the system contains a high potential for inequity, as conventionally defined (i.e., differential grants to persons with equal ability to pay and a grant structure that does not equalize ability to pay across income groups).

And ultimately, the issue of equity versus the issue of efficiency must be resolved. If graduate (or any other) education does not represent a viable investment for the individual unless society subsidizes it highly, what is gained socially by "fixing the books"? If, for example, the actual return to an investment in a machine is higher than the return to an investment in the human capital of a child of the poor, would that child not be better off if society invested in the machine and gave him title to the income? In brief, not only is subsidization of education peculiar in the incidence of its benefits, but also it is inefficient; some of the beneficiaries might be better off if subsidy funds were used in other ways.

SOCIAL BENEFITS

The fourth rationale for public support of education at all levels is that education produces "social benefits," benefits in excess of those realized by the individual. These range from more rapid technological advances and economic growth to the socio-politico-cultural value of more highly educated members of society, e.g., voluntary participation in political, artistic, and similar activities. Many of these claimed benefits derive from the employments of the educated elite, for instance, in higher education and research. These have been discussed previously. The concern here is with social benefits of graduate education itself, apart from the specific career activities of the graduate-educated.

Though the present discussion cannot resolve the debate surrounding the complex issue of social benefits,[20] I would make the following broad observations:

1. Whatever the nature of social benefits, their magnitudes almost certainly decline with increases in the proportion of the population that is educated, and they may decline at higher levels of education.[21] Extending

[20] For more extensive, and also more general discussions of the issues surrounding the debate over social benefits, see Theodore W. Schultz, "Resources for Higher Education: An Economist's View," *Journal of Political Economy* 76 (May–June 1968): 327–427; and Howard Bowen and Paul Servelle, *Who Benefits from Higher Education and Who Should Pay?* (Washington, D.C.: American Association for Higher Education, 1972).

[21] Marc Nerlove, "On Tuition and the Costs of Higher Education: Prolegomena to a Conceptual Framework," *Journal of Political Economy* 80 (May–June 1972): 178–218.

basic literacy may result in great gains to society, but continuously increasing the proportion of the population with graduate degrees probably provides only a marginal benefit—for instance, with respect to scientific discovery or to political participation and responsibility.

2. The notion of what constitutes a social benefit depends, to some degree, on the individual's point of view. Those who see graduate education as a generator of such benefits are usually the graduate-educated, and their perception may simply reflect a preference for those who resemble themselves. While this preference may justify a banding together of the educated elite to subsidize new entrants into their class, it is a weak basis for advocating that a much more diverse society collectively sacrifice to satisfy the social and cultural preferences of one restricted group.

3. The sources of technological and economic benefits need to be more thoroughly explored than they have been thus far. For all the attention devoted to the connection between education and income (both individual and aggregate), the precise mechanisms by which education increases productivity, either statically or dynamically, have not been studied in any depth. For example, the often-acclaimed relation between education and the diffusion of new technologies may depend on what proportion of the labor force is educated and on how the economy is organized. When educated persons are scarce, an increase in their numbers may result in major benefits, but after the educated reach some critical proportion of the labor force, such benefits may dwindle. Similarly, in those industries and historical periods where productive activity is fragmented and small-scale—e.g., in agriculture during the early years of this century—general increases in educational level may significantly speed up the rate with which new technologies are adopted; but as small-scale enterprise declines and as technological innovation and diffusion become better organized and routinized, this relation may weaken.[22]

4. The benefits that may derive from higher levels of knowledge and skills cannot be taken *per se* as grounds for increasing overall subsidies to formal education. Education takes place in widely varying contexts, of which the formal educational system constitutes only one part. This point should be particularly clear to an academic who spends much of his time outside of formal education, maintaining and enhancing his own human capital, human capital that would otherwise be depleted by obsolescence in a world of continually expanding knowledge. Therefore, fostering formal postbac-

[22] The basic point here is that to justify subsidization, one must show evidence of externalities or social benefits *at the margin*. Educated people may generate these benefits, but the question is whether *one more* educated person generates additional benefits. The point is relevant not only to innovation but also to any type of social benefit.

calaureate training may simply lead to a shift from other, possibly more effective, forms of continuing training.

The import of the foregoing discussion is as follows:

First, the social benefits of graduate education must be distinguished from the social benefits of the occupational activities of the graduate-educated. If their scientific or cultural contributions generate benefits for society, then it is these activities that should be subsidized. Increases in their relative wages will thus attract students into graduate schools where they can get the training necessary to enter into these activities.

Second, the generation of social benefits justifies subsidization only if the subsidy produces greater social gain than would otherwise have occurred. If those persons who benefit from subsidies to graduate education would, because of their personal and intellectual characteristics, produce social benefits in any event, then subsidization cannot be justified. The point is that such persons may make social contributions regardless of, rather than because of, their graduate training; and even if that graduate training adds to their social value, it must be shown that educational subsidies encouraged their pursuit of that training.

The socio-cultural-intellectual process by which knowledge is produced and applied is ill understood. It is clearly true, however, that the "social benefits" argument for large-scale subsidies to graduate education, apart from the ultimate career activities of the graduate-educated, is open to serious question. Indeed, subsidization of graduate education itself[23] has rarely been advocated purely on social benefits grounds.

A QUALIFIED RETREAT [24]

> That Ike—he's a modern progressive. (That's a fellow that stumbles forward everytime somebody shoves him.) Well, he's riding on the old Republican track, a one-step forward, and a two-steps back.
>
> *From* "I Like Ike" [25]

Without a prior commitment to arrive at a particular conclusion regarding the desirability of large-scale subsidization, the general conclusion has cer-

[23] That is, subsidization of graduate education as opposed to research or occupational choice.

[24] This section was motivated primarily by discussion and correspondence with Richard R. Nelson, Joseph Ben-David, and Marc Nerlove, and I must acknowledge their contributions to my own conception of these issues.

[25] Song written by Joe Glazer, Education Director of the United Rubber Workers Union, AFL-CIO, Akron, Ohio.

tainly been negative. Each of the common rationales for such support has been argued to contain serious weaknesses.

The theme that runs consistently through the preceding four sections of this chapter is that labor markets, rather than government subsidy and institutional rationing policies, should be relied upon to direct the decisions of graduate institutions and of potential graduate students. However, having stumbled forward to this conclusion, it is encumbent now to take the two steps back and point out the limitations of this critique.

As a means of indirect subsidy to undergraduate education and research, graduate-level subsidies were criticized as inefficient on two counts: first, because the benefits are dispersed to other employers of the graduate-trained, and second, because the ultimate consequences of the subsidies depend upon the employment distribution of highly trained personnel, the cost of whose training is incorrectly perceived by both employers and employees. The activities that are ultimately most heavily subsidized might not be similarly favored were subsidies explicitly distributed, and all employers have incentives to become inordinately intensive users of the graduate-educated.

The most serious qualification to this line of argument is that the methods of indirect subsidy that have evolved may, in fact, reflect the inability of society to develop explicit means of subsidization. In the closing paragraph of Chapter 2, first section, it was suggested that, "if it is desirable to subsidize undergraduate education and research, it is probably also desirable to decide explicitly which of the various components of these activities will be supported. . ." But this statement begs the question of who, in fact, should make the explicit subsidization decision. In a situation in which there are competing social interests, in which the relative benefits of alternative allocations of scarce resources can be only vaguely perceived, a plausible institutional response would be to develop implicit, decentralized modes of support that would not require any social body to make and defend a particular decision, thereby diffusing the power to command resources so as to provide at least some significant benefit to the various competing interests. In short, it may not be possible—and if possible, it may not be desirable—to replace implicit and indirect, even though "inefficient," subsidy mechanisms with direct and explicit subsidy decisions.

However, even granting this assertion, it is not clear that support of graduate education represents a desirable means of support. First, even though social means for identifying the "most desirable" allocation of resources may not be available, it may yet be possible to identify particular allocations as more undesirable than necessary. For instance, the mix between explicit and implicit subsidy devices can be altered, e.g., a shift from subsidies to graduate students to subsidies directly to undergraduates. Alternative means of indirect subsidy support can be devised, such as tax

credits to undergraduates, which may have preferred consequences. In particular, I would argue that means of support for undergraduate education and research should be devised that do not rely upon a relative reduction in the *perceived* costs of training highly educated labor. The distribution of subsidies could still rest upon decentralized decisions, but the efficiency with which the subsidized activities utilized scarce human resources would be improved.

With reference to manpower considerations it was argued that distortions resulting from the riskiness of human capital investment decisions could be compensated by means other than direct subsidization, without incurring the risk of seriously constraining the ability of the graduate education system (institutions and students) to adapt to changing patterns of social demand for highly trained personnel.

Three rejoinders to this position can be suggested. First, the position assumes that wage adjustments can, in fact, be relied upon to guide educational decisions, just as they guide other types of occupational decisions. This assumption may, however, ignore some crucial peculiarities in the nature of the activities of the highly educated. One was mentioned above: institutional limitations on the extent of interfield wage differentials.[26] If, for a variety of internal, organizational reasons, employers are unable to permit the development of marked differentials in salaries across disciplines, then other, non-price means must be developed to equilibrate labor markets. One such mechanism would be an appropriately designed system of graduate subsidies, which would encourage people to enter fields in which excess demands exist at prevailing wage levels. Particularly in the context of academic communities, in which at least the appearance of equality of status is conceived to be a critical element in defining the nature of the academic enterprise (freedom of inquiry, pursuit of scholarship, etc.), the capacity to limit inordinate differentials in material reward may be crucial to the maintenance of the essential social character of the institution.

Second, a related limitation of reliance on wage adjustments as guides to graduate-level educational decisions derives from the nature of the career activities of the highly educated. Specifically, one of the primary functions of the graduate education system is the development of scholars, persons who will, in the course of their careers, expand the frontiers of knowledge. However, by its very nature the contribution which any individual may make is almost unpredictable. The capable student may, or may not, become the innovative scholar. And before the fact, it is difficult to provide pecuniary rewards for scholarship. This fact may have critical implications for the nature of the recruitment and selection process and of rewards themselves. Thus, it may in fact be desirable to subsidize highly initial entrance into scholarly fields, simply because of the difficulty of predicting performance.

[26] See footnote 14, p. 15.

By subsidizing entrance more individuals can be attracted into scholarly activity at lower wages, enlarging the pool from which important contributors to knowledge may be drawn. The attraction at lower wages relies upon (*a*) subsidized entrance and (*b*) nonpecuniary rewards, with only (*c*) the promise of significant pecuniary rewards in the later stages of productive careers.

Finally, the types of insurance market improvements required to compensate for the risks inherent in the decision to pursue graduate training may themselves have adverse consequences. As will be discussed in greater detail in the Appendix to this monograph, a system of income insurance may have marked and undesirable effects in such dimensions as continuing investment in human capital, marriage patterns, and labor force participation behavior, particularly of women. Whether these will be quantitatively significant, or in some cases truly undesirable, is a difficult question to answer, but these potential effects certainly warrant serious consideration. While subsidies may be undesirable, the alternatives may, or may not, be more undesirable.

The equity arguments for support to graduate education were subjected to serious question primarily on two counts. First, a serious horizontal inequity is implicit in any system which differentially rewards those who will be most successful in any event, in this case the academically most successful children of the poor. Second, such support was argued to be inefficient if alternative investments carried higher rates of return than subsidized human capital investments. However, this argument assumes that class background does not distort individual perceptions regarding the benefits of graduate education. That is, need-based grants are not necessarily inappropriate, but they do require the demonstration that—even with fundamental improvements in capital and insurance markets—a person from a particular class background has a social heritage which leads him to underestimate consistently the gains to be derived from an investment in his own future. Banfield has argued that such systematic myopia—an inability to perceive future gratification—is a characteristic of the poor;[27] and Balderston has argued that this difference in time-preference for income constitutes a barrier to increased reliance on loan finance for achievement of greater equality in educational attainments.[28] If these arguments are valid, then selective (need-based) subsidization can be rationalized on both social and economic grounds as a compensatory device.

Social benefits raise again the types of issues discussed above with reference to manpower and implicit subsidy considerations. While social

[27] Edward C. Banfield, *The Unheavenly City* (Boston: Little, Brown, 1970).

[28] Frederick E. Balderston, *The Repayment Period for Loan Financed College Education* (Berkeley, Calif.: Ford Foundation Program for Research in University Administration, University of California, Paper P-15, 1970).

benefits may derive not from graduate education *per se* but from the ultimate career activities of the graduate-educated, social mechanisms may not be available by which choices can be made to explicitly subsidize the latter. Ultimately, it may be socially desirable to leave significant room for individual, decentralized participation in the decision-making process by which social support is distributed.

Similarly, the nature of scholarly activity and its implications for recruitment and "natural selection" of scholars may render an apparently inefficient system dynamically efficient in terms of its ability to generate knowledge and apply it to socially useful ends.

In terms of the dynamics of scholarly activity even the self-interested preferences of the educated elite may be unfairly subjected to skepticism. The fact that academic freedom and an insulation of academe from immediate pressures for relevance are valued by academics is hardly an indictment of this system as socially parasitic. To the contrary, whatever its imperfections and limitations it has demonstrated its capacity as an engine of intellectual advance.

Thus, in the final analysis the uncertainty of the social benefits argument should not be interpreted as a justification for eliminating social support of graduate education. As Nerlove has observed:

> Admitting that we are far from being able to measure the external benefits of post-secondary education is *not*, however, the same thing as denying that such benefits exist; it is wrong to conclude that "until this is done, the demand for subsidy in the 'public interest' must be regarded as special pleading pure and simple."[29]

[29] Nerlove, "Tuition and Costs of Higher Education," p. 192.

3 Graduate Education in Context

Many might regard the primary thrust of the preceding chapter as offering a bleak, even threatening, picture for graduate education. The primary arguments, if valid, question the justification for large-scale social support of the activities of graduate schools and departments. The implicit position is that graduate students should "pay the freight," assisted only by improvements in capital and insurance markets and in the labor market information on which they base their educational and career decisions, supplemented perhaps by limited, need-based grants. In the context of the last 15 years—a period in which governmental and philanthropic funds to graduate students and institutions flowed freely—this position may seem to be a reversion to philistinism, a rejection of all of those values that brought graduate education into such glorious bloom in the Golden Age of the 1950's and 1960's.

To an extent this view is probably true. Some measure of skepticism about the ultimate significance of vastly expanded graduate education does pervade the foregoing discussion. And clearly, even if current levels of enrollment were maintained, not to say significantly increased, subsidies would be required, as will be discussed below. A rejection of large-scale subsidization, however, does not imply that radical changes in the financial arrangements undergirding graduate education should be made. In fact, the "traditional" system of graduate education as it existed prior to the rapid expansion initiated in the 1950's did not differ markedly from a free, unsubsidized form, appearances to the contrary. The 1960's probably did witness some movement away from this traditional model, but in its

essentials, graduate education does not appear to have been radically altered by the specifically educational programs of the last decade. Rather, the changes which did occur represent perfectly predictable and even justifiable responses to basic alterations in the general environment within which the higher education system operates.

The current problems of the graduate education system reflect new changes in this environment, changes that require adaptations that are less easy and rewarding than were the earlier adaptations. The real threat is that, under the guise of maintaining the status quo, fundamental changes in the system will be attempted in response to current pressures for adjustment. The paradox is that efforts to maintain the status quo may well carry the seeds of potentially undesirable modifications in the structure, process, and content of the system.

In this chapter, the nature of the relationships between graduate education and the broader university and social context is explored, emphasizing the implications of these relationships for the nature of graduate education itself. An effort is then made to explicate the recent history of graduate education in the United States.

GRADUATE EDUCATION WITHIN THE UNIVERSITY COMPLEX

It is impossible to comprehend the role of and the constraints upon graduate education apart from the broader university environment within which it functions. The cardinal characteristic of the university is that it produces a number of different "products," the production processes of which are fundamentally interrelated. For present purposes, the most important of these joint products are undergraduate education, graduate education, and research.

The university's ability to provide graduate training—or rather, the cost at which it can provide this training—depends on the levels of its activity in other dimensions. When undergraduate enrollments or research efforts are relatively low, the cost of additional graduate training may be very high; at high relative levels of these activities, the cost may be low or even negative. In the latter circumstances, the university might find it profitable to pay graduate students to attend.

The cost of any increment in graduate enrollment will depend upon:

1. *The extent to which graduate faculty requirements can be met by replacing undergraduate faculty with graduate students in undergraduate teaching.* When the level of graduate relative to undergraduate enrollment is low, the possibility of using graduate students in undergraduate teaching may be great, and thus the cost of graduate training will be significantly reduced.

If, for example, the average graduate student teaches half-time every other year, then four graduate-student teachers will release one regular faculty member from undergraduate teaching. If the faculty–student ratio at the graduate level is one to six, then six graduate students will release 1.5 faculty members from undergraduate teaching but will absorb only one graduate faculty member. If the savings of one-half of a faculty salary are distributed to the six one-quarter-time graduate-student teachers, each would receive approximately one-third the regular faculty wage per course. Thus, if faculty represented the only cost to the university of graduate training, and if graduate students could effectively replace regular faculty, then the net incremental cost of an additional graduate student (gross cost less compensation for teaching) might well be negative.

As graduate, relative to undergraduate, enrollment increases, the degree of substitutability in undergraduate teaching between regular faculty and graduate students declines markedly. Graduate teaching assistants become progressively less perfect substitutes for regular faculty members as they take over greater shares of the undergraduate curriculum. The graduate-student teacher may completely replace faculty in, for instance, introductory courses, but at higher levels he can only "assist," e.g., grade or lead discussion sessions. Thus, at higher ratios of graduate to undergraduate enrollment, the savings on regular faculty resulting from increased graduate enrollment decline, and the net cost of increased graduate training rises.

2. *The complementarity between graduate education and research.* With variations over fields, graduate students almost invariably enter as inputs into research, either as substitutes for faculty or for other personnel. In the absence of graduate programs, nonstudents would have to be employed in research, and their wages would tend to be higher since, for the graduate student, part of the wage can be provided "in kind," with his participation in research viewed as part of the graduate-education, human-capital-formation process. In addition, the research faculty's productivity would be lower if greater faculty input were required to compensate for the less than perfect substitutability of nonstudents as student assistants.

The student's participation in research represents part of the graduate education process from which he benefits and for which he is willing to pay by receiving lower wages. Similarly, research activity itself benefits, in the form of lesser faculty input and lower nonfaculty costs. But again, as the size of the graduate program increases relative to the level of research activity, this becomes progressively less true. To some degree, larger graduate programs make possible higher levels of research; but beyond some critical point, an increase in graduate enrollment must result in declining student participation in research and an increase in graduate program costs.

The point is that what has traditionally been viewed as a highly sub-

sidized graduate education system may in fact not have been significantly subsidized at the margin, at least over most periods. Many of the apparent costs of graduate education may more legitimately be viewed as the costs of undergraduate education or research. Thus, a teaching assistant's wages may represent a desirable (negative) net graduate tuition. Further, the apparent wage of a graduate-student teacher may be even less than it "should" be—i.e., less than the net benefit derived by the university—with the difference provided as fellowship support in nonteaching years. If the appropriate wage per course were one-third that of the average regular faculty member, and if one sixth were paid as a wage in one year, with a corresponding amount provided as a fellowship in a nonteaching year, the fellowship would simply represent advance or deferred compensation for teaching. Thus, apparent subsidies actually may represent implicit payment for services rendered, in excess of the costs of graduate training *per se*. The implicit benefits of graduate programs to research are less simply identified, but the principle remains the same.[30]

Parenthetically, the interdependency in production represented by graduate education, on the one hand, and undergraduate education and research, on the other, may provide the firmest basis for distinguishing graduate from professional education and may explain why graduate programs are highly integrated with other activities of the university whereas professional programs are typically pursued in isolated, almost independent enclaves, and why significant differences in *net* pricing policy are observed. The point is not just that graduate students are both the recipients of (investors in) education and inputs into other university activities, but more important, that these activities are an integral part of traditional graduate education. The "graduate educational transformation" would be significantly different if graduate training were pursued independent of undergraduate education and research.[31]

[30] Graduate student contributions to research do not always involve a direct employee–employer relationship. A student's dissertation research and even his course work may contribute to broader research efforts without being explicitly identified as part of any supported research project. This fact has significant implications for the pricing of university research and the mechanisms by which research support is distributed within the university.

[31] How large a role the apprenticeship plays in graduate education, and what particular form it takes, undoubtedly differs from school to school and department to department. For instance, an extended research apprenticeship constitutes a much more significant part of graduate training in economics at Harvard than at Yale. Similarly, there are probably differences among fields, with teaching being uppermost in the humanities and research in the sciences. The contribution of graduate programs to undergraduate teaching is probably the most important factor in explaining the proliferation of graduate education in the public sector over the last 20 years of rapid prebaccalaureate growth, with research being only a moderate stimulus.

But to continue to enlarge graduate education relative to undergraduate education and research will necessitate increasing the costs of graduate training and also fundamentally changing the nature of the graduate educational process. At that point where more graduate students can no longer be integrated into these other university activities, graduate education will come to resemble more closely undergraduate education as well as much of professional training. Its apprenticeship component will be reduced, and the formal educational process more greatly emphasized. In this situation, a rise in "credentialism" could be expected: degrees would proliferate, and the possession of a degree—as a substitute for more personal, direct certification of competence—would become more important.

One important implication of the foregoing, somewhat intuitive model (a more formal version of which is being developed) is that a negative level of net graduate tuition (out-of-pocket charge to the student) need not mean that graduate tuition is being subsidized. On the contrary, it is quite possible that graduate students could be *paid* for attending graduate school and yet simultaneously serve to subsidize other university activities. If, for example, universities formed a cartel to restrict the growth of graduate programs during a period when the demand for graduate training was rising, a situation of excess demand might develop in which universities could restrict enrollment and pay graduate students less than the incremental benefit derived from graduate programs at that level of enrollment (or, if net incremental cost were positive, raise net tuition above the level of incremental cost), thus implicitly subsidizing some other facet of university operations, e.g., faculty wages or undergraduate education.

Viewed in this light, the rather negative and heretical arguments of the preceding chapter, which found little justification for subsidization of graduate programs, are not as threatening as may first appear, and the qualified retreat may not be a significant capitulation. To argue that there is no convincing rationale for subsidies to graduate education is not the same as advocating a simpleminded estimation of "full cost"—e.g., graduate faculty salaries and other direct costs—that should be paid by graduate students. Rather, the cost of graduate education must be assessed in the broader university context, within which the true full cost of graduate training may be very low or even negative.

At this point, the relation between net incremental cost and tuition should be mentioned. As used in this discussion, the term *net incremental cost* can be defined as the increase in the total operating cost of the whole university as a result of adding one graduate student, if the levels of all other university activities are held constant. Note that net incremental cost is computed after faculty and all other resources have been adjusted in response to the increment in the scale of the graduate program. This net incremental cost may

be either positive (if the graduate student absorbs more resources than he frees) or negative (if the reverse is true). Net incremental cost thus represents the value of all resources required by the university to enlarge its graduate program, apart from the input of the graduate student himself.

Ideally, the charge to the student, his net tuition, would equal the net incremental cost to the university. In fact, of course, the tuition charged by the institution may be more than or less than incremental cost. To the degree to which these two measures diverge, however, the student is subsidized by, or serves to subsidize, other university operations. Note that the subsidies implicit in price distortions (deviations of net tuition from incremental cost) and explicit subsidies received by the student (e.g., portable fellowships) are distinct from one another. The net cost to the student would then be the sum of tuition (positive or negative) and foregone earnings, less any explicit subsidy.

Employing this schema, one can make a strong case for a pricing policy of net tuition equal to net incremental cost. Tuition, whether positive or negative, and foregone earnings would then truly reflect the social costs of graduate education, and relative to these costs, the potential student and society could assess the benefits of that educational experience. The internal benefits of graduate programs—i.e., benefits to the university's programs of teaching and research—would be reflected in the level of net tuition charges. Social benefits, those external to the university, would be accommodated by an explicit subsidy wedge between the net tuition charged by the institution and the payment made by the student.

If the university pursued this pricing policy toward all of its products—undergraduate, graduate and professional education, and research—revenues might be either greater or smaller than its total costs. If the latter, a subsidy would be warranted, but it would go to the university as a whole rather than being allocated to such individual functions as graduate education. The predominance of public and private nonprofit institutions of higher education is indirect evidence that optimal, consistent pricing policies would lead to overall losses. Public institutions recoup these losses directly from the public fisc, while private institutions rely on private philanthropy indirectly encouraged by the public fisc. Not that institutional pricing policies are now optimal, but they may be sufficiently close to correct policies to generate overall deficits. Alternatively, of course, these deficits may result from prices generally below optimal levels. But correct pricing would not necessarily eliminate deficits in higher education institutions.

However defensible current university pricing policies, the point is that the optimal price structure is independent of the size of the deficit and of the source of institutional subsidy which compensates for that deficit. That is, if optimal pricing implies a loss, subsidy support to the institution should be

provided on terms that do not lead it to distort prices of individual products.[32]

The model set forth here has several interesting implications, some of which can eventually be used to test its validity and usefulness, an effort unfortunately beyond the scope of the present discussion. It is sufficient here simply to indicate several of these:

1. *The incremental cost of graduate education (ideally equal to net graduate tuition, positive or negative) will probably vary appreciably both over fields and within fields over time.* Graduate programs in fields where no undergraduate programs exist and little research is done (e.g., little-studied, exotic languages) are an obvious extreme. In these fields, one would expect net cost to be very high, approximating "full cost" simplistically conceived. At the other extreme, the basic sciences (e.g., physics, chemistry, and biology) might have very low (or even negative) net tuition, since in these fields basic university research is common and provides employment-learning opportunities for students, as well as absorbing such direct costs as laboratories.

[32] While a pricing system that equates net incremental costs and tuition may be socially optimal, actual price policies may not conform to this ideal, nor are there necessarily institutional or market forces that lead the system to this type of price configuration. If institutions act to maximize profits (or minimize losses), then a very different price structure may evolve. The optimal price configuration would result if universities felt they had no control over the prices of any of their products, e.g., if they assumed that they could acquire any desired number of students at prevailing net tuition levels. The university would expand enrollment until the prevailing tuition level equaled net incremental cost. This enrollment level would satisfy the conditions for a socially optimal price system and simultaneously maximize institutional profits (or minimize losses). Such a situation would be a case of perfectly competitive behavior, to use the economist's term. But if (as is likely) elements of monopoly exist—i.e., if an institution can attract more students only by reducing net tuition—and if interinstitutional price differentials can be sustained, then profit-maximizing behavior would result in tuition levels above the optimum and, correspondingly, enrollment levels below the optimum.

It is difficult to suggest solutions to the problem of nonoptimal pricing behavior, particularly since it is hard even to confirm its existence. Net incremental cost is not an easily observed variable and actual net tuition is equally difficult to determine, given the wide variety of direct and indirect modes of payment to graduate students. The first step is to try to measure these crucial variables and to identify their determinants. Beyond this, the optimality of university policies for graduate education depends upon pursuit of correct policies toward undergraduate education and research. If the university has a monopoly in certain areas of research, then the resultant profit-maximizing restriction in scale of the research program will lead to a less than optimal level of graduate program activity even if the institution does not have a monopoly in the graduate domain and pursues optimal pricing policies. Thus, optimality in one dimension is possible only if the university behaves optimally in all other dimensions as well.

Moreover, large proportions of undergraduates are enrolled in basic courses to which graduate students can contribute as substitutes for regular faculty. The same might be true in those humanities (e.g., history and English) in which direct costs are low (because of absence of laboratories, etc.) and opportunities for undergraduate teaching are great.

Net tuition, or cost, in a field may vary significantly over time with changes in graduate enrollments relative to undergraduate enrollments and research. If an unusually large number of graduate students entered a field because of the opportunities it presented late in their undergraduate careers and if the "market signals" then changed sharply (e.g., research in the field were reduced drastically), then undergraduate demand could also decline. Costs would then greatly increase as a result of (*a*) the abnormally large graduate enrollment, (*b*) the decline in research effort itself, to which graduate students would have contributed and from which they would have benefited, and (c) the induced decline in undergraduate enrollment, a decline which would cut off teaching opportunities for graduate students.

This scenario demonstrates graphically the importance of developing more adequate knowledge of the market for the graduate-educated, as discussed in the preceding chapter. If the graduate education industry exhibited, in the short run, an approximation to "constant costs"—i.e., could expand or contract without significantly altering net incremental cost—then a very slow or cyclical adjustment process might not involve major social costs. Given the highly interdependent system outlined above, however, the costs of recurrent contractions and expansions might be high, in which case efforts to stabilize the adjustment process could have major benefits. Again, these efforts need not involve subsidies in any true sense; rather, to stabilize the market, a university, or an intermediating agency, if it had sufficient information on future market prospects, could sell "futures" in graduate training, i.e., could attempt to redistribute or equalize enrollment over time.

2. *Other things being equal, rapidly rising research efforts or undergraduate enrollments will raise a university's demands for graduate students, thus reducing (or limiting increases in) net graduate tuition.* If graduate enrollment increases at a slower rate than undergraduate enrollment, then universities would probably bid for graduate students, also reducing net graduate tuition. If the demand for graduate education also rises, but at a rate greater than that for undergraduate enrollment or research, increases in these other university activities might at least mitigate the rise in graduate tuition which would otherwise occur.

3. *Institutions offering graduate programs will proliferate in periods of rising undergraduate, graduate, or research demands.* In periods of rising

undergraduate demands, faculty wages will be bid up as the higher education sector attempts to attract credentialed persons away from nonacademic employers. This increase in the wages of the highly educated will increase not only the demand for graduate education but also the desirability of graduate students as inputs into undergraduate education. The ability of established universities to increase undergraduate enrollments being limited, other institutions will be strongly motivated to inaugurate graduate programs, since those programs will become more expensive in existing graduate institutions and since undergraduate costs will be reduced in those institutions inaugurating graduate programs. Growing research demands would create similar incentives by the same mechanisms.

4. *Contractionary pressures on graduate enrollment in response to declining research activity will be greatest in those institutions whose undergraduate enrollments are growing most slowly and in those most heavily dependent on the relation between graduate education and research as the basis for graduate support.* Rapid undergraduate enrollment growth is probably the factor that best explains the proliferation of graduate programs. More established institutions, those with wider reputations, can probably least easily respond to increased undergraduate demand but can most easily accommodate increased research demand. Thus, any contraction in research support will differentially strike the more established institutions.

As the last point indicates, the interest quotient of this model becomes greater as the model is elaborated to recognize heterogeneity within the graduate education sector. In particular, it can be used to explain recent differences between the public and private sectors with respect to the evolution of graduate education. Growth in public institutions is probably accounted for by increasing undergraduate enrollment, with graduate students then acting as apprentices in teaching; growth in private institutions, on the other hand, is probably dominated by increased research support, with derivative support for expanded graduate programs. If these observations are true, then the career disposition of graduates would reflect these differences in the product mixes of the two groups of institutions.

Similarly, the model should help to explain changes in the role of, for example, nonuniversity research institutes. If research efforts increase rapidly, and if constraints are placed on the growth or adaptation of research in established universities, nonuniversity research centers will probably proliferate. But over time, the mutual benefits of a research–graduate education linkage would suggest either that graduate programs be established within previously nonacademic research organizations or that close ties, formal and informal, be developed between these centers and graduate institutions.

The benefits of such a close linkage may, however, depend on the type of research activity pursued. *A priori,* one would expect the university to have the advantage in relatively basic research, i.e., research not directed at the development of immmediately applicable technologies. Thus, should the overall composition of research activity shift from the basic toward the applied or developmental, the share of all research performed within universities would be adversely affected, and in consequence the cost of graduate programs of any given size would increase.[33] Internal, organizational dysfunctions may be a more important source of the university's comparative disadvantage in some areas of research, in which case the increasing costs of graduate programs might provide an effective incentive to institutional reorganization within the university, lessening the adverse effects of change in research emphasis.[34]

The model presented here is not a fully articulated representation of graduate education within the context of the higher education system. Further efforts to develop such an explicit model should prove valuable to understanding the workings of the system and should be vigorously pursued. But, even in its crude, intuitive form, this model provides a framework for interpreting the recent history of graduate education in the United States. The remainder of this chapter is devoted to the historical application of the model.

THE RECENT HISTORY OF GRADUATE EDUCATION

The real test of a model is the light it sheds on actual experience. Specifically, does the recent history of graduate education in the United States become more comprehensible in terms of this model? Would the model have predicted the developments which have occurred over the past 15 years? As the preceding section strongly implies, the model does seem to have significant explanatory power. The purpose now is to examine this explanatory force, using the meager data available.

The most important facts of the last two decades—important at least for the evolution of graduate education—relate to the growth of undergraduate enrollments and of research.

[33] George J. Stigler, in "The Theory of Economic Regulation," *Bell Journal of Economics and Management Science* 2 (Spring 1971), pp. 3–21, argues that the universities' declining share of research funds is attributable to an inability to control entry into the research industry. But this argument does not adequately address the issue of the university's apparent technological-economic advantage in some types of research.

[34] The possibility of such accommodation within the present situation of graduate education is discussed in Chapter 4.

The Undergraduate Enrollment Setting After 1950

A confluence of events beginning around 1929 created a period, approximately 1950 to 1970, which will certainly rank as one of the more peculiar in the history of U.S. higher education. The first was the depression of the 1930's, the demographic effects of which are well known. The decline in births which accompanied the depression produced a continual decline in the 18- to 21-year-old age group from 1947 to 1953. Only in 1960 did this population group reach its 1947 level.

The impact of this decline on higher education would, under more normal circumstances, probably have been more than offset by secularly increasing rates of college attendance. As indicated in Table 5, if it is assumed that the ratio of undergraduate enrollment to college-age population would, under normal circumstances, have increased linearly from its 1939 value of 12.8 percent to its observed 1955 value of 27.6 percent, undergraduate enrollment in the period from 1947 to 1955 would have increased at an average annual rate of 2.9 percent, a rate that closely approximates that of the

TABLE 5 Undergraduate Enrollment

		Actual		Hypothetical		
	18 to 21 Population	Undergrad. Enrollment (thousands)	Ratio to 18-21 pop.	Undergrad. Enrollment (thousands)	Ratio to 18-21 pop.	War, GI Bill, etc., Effects (Actual-Hypothetical)
1919	7386	514	0.070			
1929	8862	930	0.105			
1939	9582	1227	0.128	1227	0.128	0
1947	9276	2157	0.233	1873	0.202	+284
1949	8990	2140	0.238	1981	0.220	+159
1951	8742	1828	0.209	2088	0.239	−260
1953	8441	1977	0.234	2173	0.257	−196
1955	8503	2347	0.276	2347	0.276	0
1957	8844	2622	0.297			
1959	9225	2874	0.312			
1961	10246	3328	0.324			
1963	11129	3756	0.338			
Average Annual Growth Rates (%)						
1919-1929	1.8	6.1	4.1			
1929-1939	0.8	2.8	2.0			
1947-1955	−1.1	1.1	2.1	2.9	4.0	
1955-1963	3.4	6.1	2.6			
1963-1970		7.9				

SOURCE: Derived from Harris, *Higher Education*, pp. 412-413.

1930's (2.8 percent) but is significantly less than that of the 1920's (6.1 percent). Together, these statistics suggest that the rate of enrollment growth in the 1930's was slowed by the depression, whereas the rate in the 1950's was reduced by the much lower birth rates of the 1930's.

In fact, enrollment history did not correspond to this projection. The consequences of World War II and of the Korean conflict, superimposed upon the consequences of the depression, served to produce a very different history. Enrollments in the early 1940's were clearly depressed by the demands of the war, but by 1946 enrollment was significantly inflated by the influx of veterans, particularly under the stimulus of the GI Bill. Thus, actual enrollments between 1945 and 1950 exceeded levels which would have been predicted by significant margins, possibly by as much as 284,000 (13 percent of actual enrollment) in 1947. In combination with the depressive effects of the Korean conflict in the period from 1950 to 1953, this unusual level of college attendance in the late 1940's resulted in marked enrollment declines between 1950 and 1952. Undergraduate enrollments did not rise again to their 1947 peak of 2.2 million until at least 1954.

The net effect of these exogenous shocks to the system was an average annual rate of growth in undergraduate enrollment over the period from 1947 to 1955 of only 1.1 percent. (Parenthetically, over this same period, graduate enrollments increased at approximately 4 percent per year, a rate also undoubtedly stimulated by World War II and the GI Bill.[35] In consequence, the stage was set for an "explosion" of undergraduate enrollments as the effects of the wartime rise in birthrates and the postwar baby boom began to be felt in higher education. The 18- to 21-year-old population group increased continuously after 1953, and at a clearly accelerating rate after 1959.

The predictable explosion did, of course, occur. The 1.1 percent average undergraduate growth rate of 1947 to 1955 increased to 6.1 percent in the period from 1955 to 1963 and further to 7.9 percent from 1963 to 1970.

This rapid and sustained increase in undergraduate enrollments had two primary consequences for graduate education. First, it was a prime contributor, through increases in demand for qualified faculty, to the sudden rise in salaries of the graduate-educated. For example, between 1950 and 1955, when undergraduate enrollment was virtually stable or declining, the real (price-increase-adjusted) starting salaries of new Ph.D.'s increased by only 1.6 percent per year, in contrast to an average economywide rate of 2.8 percent for all salaries and wages.[36] In the period from 1955 to 1960, however, real starting salaries of Ph.D.'s increased at a much higher 2.7

[35] Harris, *Higher Education*, p. 415.
[36] Freeman, *College Trained Manpower*, p. 78.

percent annual rate while all salaries and wages increased at only 2.1 percent. The predictable result of this increase in demand for the graduate-educated, as reflected in the more rapid growth of salaries, was greater demand for graduate education.

The other favorable consequence of rapid undergraduate enrollment growth was the decline in the costs of any level of graduate training. In terms of the model, an increase in the scale of undergraduate education should provide an incentive to institutions to expand or initiate graduate programs, due to the substitutability of graduate students for regular undergraduate faculty. The effective cost to the institution of an additional graduate student (at any level of graduate training) should have declined as a result of increased undergraduate attendance. This increasing "profitability" of graduate programs should, then, have exerted significant downward pressure on net tuition (nominal tuition less compensation for teaching, etc.).

But, the undergraduate enrollment growth most relevant to determining the university's supply of graduate training (demand for graduate students) is not the total but that part of the total which occurred in graduate institutions. On the basis of the preceding discussion, a significant increase in the number of institutions offering graduate training would be expected to accompany rapid growth in undergraduate enrollment and this effect must also be taken into account.

The proliferation of graduate programs was certainly quantitatively significant over this period. The number of institutions offering the Ph.D. increased from 158 in 1953 to 175 in 1958, and further to 212 in 1964.[37] As the model would predict, the annual rate of increase in the number of these institutions, 2.1 percent from 1953 to 1958, 3.2 percent from 1958 to 1964, was greater in the latter period, one of more rapid undergraduate expansion, than in the earlier period.

Ideally, the effect of the undergraduate expansion on the universities' demand for graduate students could be predicted by estimating the change in undergraduate enrollments in institutions with graduate programs. Unfortunately, inadequacies in the data preclude this relatively precise approach. Instead, I have used total undergraduate and first professional enrollments in all four-year colleges and universities, i.e., in those institutions that might, but need not, have active graduate programs. This method introduces into the analysis a potential source of bias, even the sign of which cannot be reasonably estimated.

In the period from 1957 to 1960, the distribution of increased undergraduate enrollments across institutions seems to have been only marginally unfavorable to (actual and potential) graduate institutions (Table 6). The annual rate of undergraduate growth in these institutions was 5.1 percent,

[37] Harris, *Higher Education*, p. 379.

TABLE 6 Annual Percentage Growth in Graduate Enrollment and Related Variables, 1957–1972

	Undergraduate Enrollment		Graduate Enrollment		Research (College & University)	Faculty Salary	Real Research[b]
	All Institutions	4-year Institutions	Total	First Year			
1957-1960	5.3	5.1	7.3	11.4	15.8	5.6	10.2
1960-1965	9.3	8.6	10.3	11.7	17.2	5.3	11.9
1965-1967	7.5	6.4	8.7	9.1	13.1	6.1	7.0
1967-1970	6.4	5.0	9.5	7.4	7.0	(7.0)[a]	0
1957-1967	7.7	7.1	9.1	11.1	15.9	5.6	10.3
1967-1972					5.5	(7.0)[a]	(−1.5)

[a] Author's estimate.

[b] Growth rate of research less growth rate of faculty salaries.

SOURCE: Derived from Harris; *Higher Education*, p. 274 and p. 514; Carnegie Commission on Higher Education (unpublished data), National Science Foundation, *National Patterns of R & D Resources: Funds and Manpower in the United States—1953–1972* (Washington, D.C.: U.S. Government Printing Office, 1972), pp. 24–25.

compared with a national rate of 5.3 percent. Similarly, in the period from 1960 to 1965, these institutions increased nongraduate enrollments at an 8.6 percent annual rate, while national enrollments increased at a 9.3 percent rate. This relatively rapid expansion in undergraduate enrollments at universities in the early phase may, in fact, reflect the significant elasticity of supply of undergraduate education permitted by the existence of graduate programs. Particularly in a period when faculty wages are rising rapidly, the capability of substituting graduate-student teachers for regular faculty may give universities a sufficient advantage over exclusively undergraduate institutions, at least in the short run, to overcome the established institutions' limited ability to expand total enrollments.

This comparative advantage, however, depends critically on the relationship between graduate and undergraduate enrollments. Should graduate enrollment increase more rapidly than undergraduate enrollment, the marginal benefit to undergraduate programs of increased graduate enrollment declines. Furthermore, as the graduate students who enter the universities in response to increased wages and to an enlarged university supply of graduate positions complete their graduate training and enter the labor market, they would presumably depress faculty wages, reducing somewhat the universities' comparative advantage. Perhaps more important, the high attrition rates of graduate students provide a relatively low-wage source of "semicredentialed" faculty for nonuniversity teaching positions.

As a result, the virtual equality of national and university undergraduate growth rates prior to 1960 or 1965 was replaced by a marked divergence thereafter. For the full 10 years between 1957 and 1967, *total* undergrad-

uate growth exceeded that of undergraduate growth in four-year institutions, 7.7 versus 7.1 percent annually. Nonetheless, even in the period from 1965 to 1967, undergraduate enrollments in universities increased sufficiently (6.4 percent per annum) to facilitate the supply of graduate training. But by the end of the 1960's this rate of growth had fallen precipitously, averaging 5.0 percent between 1967 and 1970.

The Post-1950 Research Setting

In addition to the rapid growth in the undergraduate population, national demands for research swelled markedly after 1950, as demonstrated by Table 7, increasing both the demand for and the supply of graduate training. Total research and development spending increased at an annual rate of 9.8 percent between 1953 and 1955; 25.6 percent between 1955 and 1957; 11.4 percent between 1957 and 1960; and 8.3 percent between 1960 and 1965. Rates of increase of these magnitudes certainly contributed to the rapid rise in salaries of the graduate-educated, and significantly stimulated the demand for graduate training. Equally important, the share of

TABLE 7 Research and Development Expenditure, 1953–1972

	Total R & D ($ million)	University and College R & D ($ million)	University as % of Total	Average Annual Growth Rate (%)	
				Total R & D	University R & D
1953	5207	334	6.4		
				9.8	10.7
1955	6279	409	6.5		
				25.6	13.9
1957	9912	531	5.4		
				11.4	15.8
1960	13730	825	6.0		
				8.3	17.2
1965	20439	1822	8.9		
				7.6	13.1
1967	23642	2329	9.9		
				3.6	7.0
1970	26287	2856	10.9		
				3.2	3.2
1972	28000	3050	10.9		
1957-1967				9.1	15.9
1967-1972				3.4	5.5
1953-1972				9.3	12.3

SOURCE: National Science Foundation, *National Patterns*, pp. 24–25.

research and development activity taking place in colleges and universities, which had hovered between 5.4 and 5.7 percent in the 1956-to-1959 period, steadily increased throughout the decade of the 1960's, reaching 11 percent in 1971. Thus, although total research and development expenditure increased at only a 9 percent average annual rate in the period from 1957 to 1967, college and university research increased at an average annual rate of 15.9 percent.

To summarize, the rapid growth rates of both undergraduate enrollments and research expenditures served to stimulate salary increases for the graduate-educated, leading to expanded demand for graduate training. As a consequence of the increase in graduate enrollment—and given the desirability of graduate students as undergraduate teachers—universities were at least initially able to maintain their collective share of total undergraduate enrollment, thus offsetting the rise in the costs of providing increased graduate training that would otherwise have occurred. Augmenting the expansion of graduate training in established institutions, a number of institutions inaugurated graduate programs in this period. Thus, the rise in undergraduate enrollments served to stimulate both the demand for and the supply of graduate education.

Similarly, the increase in research activity operated on both the demand and supply of graduate training. The overall increase stimulated demand, and—given the complementarity between graduate education and research—the universities' share of total research grew, limiting the cost (and net tuition) increases which would otherwise have been a concomitant of a major expansion in graduate enrollment. Parenthetically, the rapid rise in university research may help to explain the relative decline in the universities' share of undergraduate enrollments; for established institutions, research and undergraduate education represented substitute products, and these institutions found the former to be more profitable.

An overview of the decade from 1957 to 1967 clearly reveals these phenomena. Over the entire period, the growth of graduate enrollments exceeded that of university undergraduates, 9.1 percent annually versus 7.1 percent. In consequence, the number of undergraduates per graduate student decreased from 8 in 1957 to 6.7, 10 years later. All else being equal, this change would be expected to have increased net graduate program costs, but the concurrent increase in university research (15.9 percent annually) should have more than compensated for the altered ratio. Of course, this rate of growth in research expenditures is computed on the basis of current, undeflated dollars. The relevant factor is the rate of increase in real research activity. If the 5.6 percent annual nominal increase in average faculty salaries is used as a proxy for a research price index, however, the resultant 10.3 percent increase in real research effort should still have been adequate to hold down the cost of graduate training.

Thus, although graduate enrollment grew much more rapidly over this decade than did undergraduate university enrollment, the even greater increase in real research spending (10.3 percent) should have alleviated the pressure for net tuition increase. Graduate students should still have represented desirable inputs into other university activities, even at the margin.

The question of the role of greatly expanded fellowship, traineeship, and related graduate-study awards necessarily arises here. To some degree, such awards should probably be viewed as implicit subsidies to university research. In general, their distribution mirrored, both over fields and over institutions, the distribution of supported research efforts. Thus, awards to graduate students may simply be one mode by which either the universities or external agencies support research activity.

To some extent, however, net tuitions probably did rise, and to that extent these awards may have been intended as pure subsidies to graduate training, intended to enlarge the demand at the new, higher levels of net tuition. More likely, given the bases on which such aid was awarded over this period, the effects may have been entirely "intramarginal." That is, if aid is awarded on the basis of ability and achievement, and if persons with these characteristics are highly likely to pursue graduate training in any event, then those who received them may simply have been made wealthier. This interpretation is supported by the observation of the Newman *Report on Graduate Education* that the fields that received the greatest number of fellowships in the 1960's did not expand (although it is possible that they may not have contracted as much as they otherwise would have). In this event, the universities' ability to capture the benefit of fellowships depends on the degree of competition between universities and on the portability of the fellowships. Fellowship support would be simply a substitute for university support (i.e., the university could fully tax or confiscate the benefit) if competition were very low or if the fellowship were institutionally tied; otherwise the benefit would accrue to the student. In the latter event the fellowship would have no effect on enrollment. In the former case, the effects on enrollment would depend on the universities' uses of the captured fellowship funds. If used to support marginal graduate students, they could have a significant effect, whereas if they were used for "conspicuous consumption" —e.g., more elaborate buildings or higher salaries for a few faculty and administrators—the effect could be nil.[38]

Of course, it is likely that, in some fields, federal (and other) fellowship support had marked effects on enrollments. For instance, in those fields in which incremental costs (and hence net tuitions) would have been very high—deterring potential students who, in the absence of support, would have chosen other fields or careers—fellowship availability may have made

[38] The term *marginal student*, as used here, refers to the decision to pursue graduate training versus some other career, not to the academically marginal student.

a great difference to enrollment. With the fellowship tied to the particular field, the probably high elasticity of student demand would have made it difficult for the institution to capture the benefit. Similarly, such support may have affected students' choices of particular subfields and specialties. Again, the higher the student responsiveness to cost differentials, the more difficult it is for the institution to capture the full benefit. Language programs come immediately to mind as examples of the first case, scientific specialties as examples of the second.

Whatever the precise role of federal and related fellowship programs, net graduate tuition should not have been under significant upward pressure in the pre-1967 period, even though graduate enrollments expanded at in excess of a 9 percent annual rate. But the picture changed dramatically after 1967. The growth rate of the university undergraduate population fell from 7.1 percent (1957–67) to 5 percent (1967–70), while the growth rate of *real* university research expenditure declined from 10.3 percent (1957–67) to approximately zero (1967–70). In this inauspicious context, the rate of increase of graduate enrollment actually accelerated, from 9.1 percent (1957–67) to 9.5 percent (1967–70).[39] As a result, the undergraduate/graduate student ratio, which had fallen from 8 to 6.7 percent between 1957 and 1967, fell further to 5.6 by 1970.

Thus, since 1967, the costs of graduate training must have risen significantly, and this rise is the source of much of the current distress in graduate education. From a situation in which rapidly rising graduate enrollments were "profitable" for universities at little or no increase in net tuition, declining undergraduate and research demands have made continuing high levels of graduate enrollment growth a very significant financial burden at prevailing net tuition levels. Given numerous inertias in the system—e.g., lags in adjustment of actual net tuition, lags in the response of graduate student demand to declining career opportunities, and the partial dependence of the demand for graduate education on net tuition levels—the universities at first directly bore the effects of the changed situation. Indirectly, potential graduate students have been adversely affected by increased rationing as universities have attempted to reduce costs at existing net tuition levels by restricting (rationing) enrollment. And, to some extent, enrolled students have felt the consequences as increased incremental costs have been met by raising net tuition levels.

Thus, in the current period, the system is being forced to respond to a radical reversal of the conditions which persisted from the mid-1950's until the late 1960's. Difficulties arise primarily because of lags in the adjustment process. Graduate enrollment continued to increase because new entrants

[39] However, the rate of growth in *first-year* graduate enrollments declined from 11.1 percent in 1957–67 to 7.4 percent in 1967–70, an indication that baccalaureate-holders recognized and responded to adverse changes in the circumstances surrounding graduate students.

were responding to conditions prevailing in the recent past but undergoing major changes in the present. Similarly, universities found it difficult to justify basic changes in pricing policy (increases in net tuition) in response to what were hoped to be short-term exigencies.

The necessity now is to recognize that the experiences of the past 5 years are not temporary aberrations. Most obviously, while many of the basic changes are only now being recognized and understood, they are not of recent origin; they represent continuations of trends which began (old trends which were reversed) as early as the mid-1960's. Second, substantial evidence suggests that conditions will get worse before they improve. The decline in university-level undergraduate enrollment reflects the reestablishment in the 1950's of demographic trends that go back at least to the nineteenth century. We know now that the 18–21-year-old population will be virtually stable throughout the 1970's and will decline between 1980 and 1990 (see Figure 1). This is not theory but certainty, since all of the members of these cohorts have already been born. Whether current demographic trends will continue is, of course, open to question, but uncertainties concerning conditions more than 20 years in the future are not particularly germane to the issue of the appropriate current level of graduate training.

The question of research is more difficult. Research expenditure, presently declining at a rate of at least 1.5 percent per year in real terms, is not the product of family formation decisions made 20 years ago, but of current choice; in particular, of governmental policy. Military considerations obviously played a major role in the research explosion of the 1950's and 1960's, and equally obviously they play a significant role in the current decline. But the permanence of this source of contraction is an unknown. Also, new motivations for extensive research—e.g., research into human resources or the environment—may well replace the stimulus of the military.

Equally possible, the current contraction may be due to more fundamental factors than a diminishing and uncompensated military demand. Knowledge and technologies do not advance in a continuous, monotonic process but exhibit recurrent cycles in which periods of major upward movements are followed by prolonged periods of adjustment and diffusion of the new knowledge and technologies. In Schumpeterian terms, the latter process constitutes the depression phase in the long waves of economic change and the current period may well be one in which 30 years of dramatic advance is followed by a slow process of accommodation and internalization of the opportunities that the preceding period has created. If this is so, a reversion to euphoria is not likely, although it is still possible that appropriate directions of evolution in education and research could reduce or at least qualify the consequences for graduate education

The next chapter is addressed to what implications these current tendencies and future possibilities have for policy.

A postscript, however, is in order. The discussion has focused almost

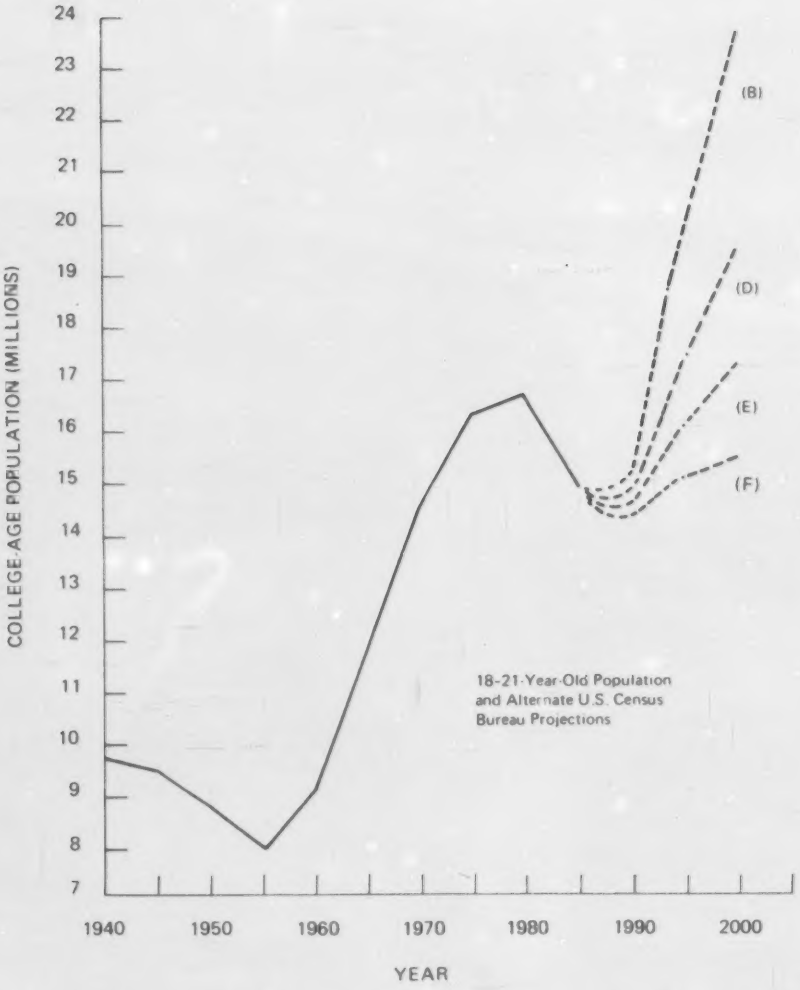

Figure 1 The college-age population, 1940–2000, alternative projections. [Carnegie Commission on Higher Education (unpublished data)].

exclusively on factors and processes that are either internal to or operate through the university and the broader higher education system. This might seem to suggest that external factors were unimportant to the evolution of graduate education, an inference that is unwarranted. Clearly, demographic

processes and the changing patterns and level of research demand were exogenous to the higher education system. The stress on the university reflects its importance in translating these external forces into their consequences for graduate education. Were the technology and organization of the higher education system significantly different, the implications of these external changes for graduate education would likewise have been different.

Thus, the model views the university as the complex intermediary between external phenomena and resultant responses in graduate education. This intermediation is complex precisely because of the observed interdependencies, in production and in demand, between graduate education, undergraduate education, and research. Unlike the proverbial "widget" of the elementary economics text, the demands and supplies of which are basically independent, the demand for graduate education, or for the graduate-educated, to take the process back one step, is not independent of the demand for undergraduate education and research, and these alter the university's capacity to supply graduate training opportunities. To stress these interdependencies is not to deny that external, independent factors are also relevant.

The failure to consider explicitly the political dimensions in the evolution of higher education warrants mention. This chapter has argued that many of the responses within the higher education system to a changed environment have been perfectly predictable in terms of economic forces. However, these have often taken the immediate form of political decisions, e.g., to increase faculty salaries or university undergraduate enrollments. The question, of course, is whether these legislative–political decisions can be viewed as the *result* of economic forces.

It is not necessary to picture the process of political decision as nothing but a ratification of economic facts and market dictates. Clearly, economic considerations represent one set of factors entering the political process, but their weight, relative to that of other factors, is certainly a legitimate question, though one beyond the scope of the present analysis. Were the evolution of graduate education to defy explanation on the basis of economic considerations, then it would be immediately necessary to search the political area for an explanation of this bizarre finding. Such, fortunately, is not the case; but this statement does not deny the importance of political factors which have been submerged in a discussion which has emphasized the interplay of market forces.

4 The Continuing Evolution of Graduate Education

The ultimate conclusion of the analysis in Chapter 3 is that the conditions which both elicited and facilitated the unprecedented growth of graduate education over the last two decades no longer exist and that the sector must now adapt to new circumstances and demands. The most important factor in this growth was the relation of graduate training to undergraduate education and research. Had not both of these components expanded rapidly, neither the demand, nor the opportunities for graduate training could have expanded as rapidly as they did. Net incremental costs (and presumably net graduate tuitions) would necessarily have been much higher and increased more rapidly, and graduate enrollments would have increased more slowly.

Over this period the graduate education system was free to devote itself to what it did best: the production of research faculty.[40] But now, the social demand for both academic research and teaching is declining, at least relatively. Graduate education is in midpassage. Its nature and role in the indefinite future will be defined by its responses to the newly evolving situation.

CURRENT TENDENCIES: IMPLICATIONS FOR GRADUATE EDUCATION

The established order in education has come under increasing stress during the contemporary period. Because of its sensitive position, graduate educa-

[40] The term *research faculty* is used here to indicate an orientation which, at least by intention, is broader than simply teaching but involves some kind of scholarly activity.

tion will unavoidably be influenced by any significant changes in the broader educational process. Similarly, the research process contains tendencies for change that could have a major impact on the relation of research to the graduate education process as traditionally conceived.

Toward Universalization of College Attendance

By 1970, the proportion of the college-age population actually enrolled in prebaccalaureate programs had reached 47 percent, in contrast to 37 percent in 1963. As the college attendance rate has increased, many persons have advocated the universalization of not only the opportunity for, but also the experience of, higher education. In part, this position is a response to the fact that, while the probability of completing high school has increased dramatically over the last century, the probability that a high school graduate will attend college has risen only slightly.[41]

Significantly greater rates of college attendance seem to have obvious implications for graduate education. The college-age population will increase very slowly during the 1970's, and will even decline after 1980, but if the proportion of those who attend college also increases sufficiently, the effects of these demographic facts on undergraduate enrollment could be nullified. If this nation moves rapidly enough toward the universalization of college attendance, the Golden Age could be perpetuated: the demand for, and the universities' capability of supplying, graduate education would be maintained.

Two related factors, however, suggest that these "obvious" implications may be an overly optimistic view of the potential consequences of rising undergraduate enrollment rates. Both factors have to do with the increasing diversity of the college population. First, the benefit on the supply side depends on the capability of universities to capture a greater proportion of undergraduate enrollment. The experience of the past 20 years shows this to be unlikely, since the proportion of undergraduates in 2-year colleges went from 12 percent in 1955 to 21 percent in 1970.[42] As was pointed out in the preceding chapter, the share attracted into universities and 4-year institutions was maintained only in those years when capacity constraints

[41] Robert H. Berls, "Higher Education Opportunity and Achievement in the United States," in *The Economics and Financing of Higher Education in the United States* (Washington, D.C.: U.S. Government Printing Office, 1969), p. 146. The attendance rates given in this book relate college enrollment to the college-age population, not to that part of the population that successfully completed high school. Thus, there is no inconsistency between a change in the former proportion from 7 percent in 1919 to 47 percent in 1970 and only a marginal change in the latter, since the probability of graduation from high school has increased over the same period (from 17 percent to over 80 percent). See Harris, *Higher Education*, p. 418.

[42] Carnegie Commission on Higher Education, unpublished data.

on the whole system were greatest, i.e., in the initial period of rapid growth in undergraduate enrollments. Thus, it would be most surprising if the present trend away from the universities were reversed in a period when the system is experiencing relative slack.

The unlikelihood of such a reversal is evidenced even more in the growing diversity of the undergraduate population. Relatively homogeneous when college attendance was the exception rather than the rule, the college population has become much more heterogeneous as we move toward universalization. Quantitatively, this heterogeneity suggests that the university may become a less, rather than more, important part of the postsecondary educational system. Because it embodies the most "classical" form of higher education, the university may become less competitive at the "enrollment margin," whereas the less elitist levels of the system may become more competitive.

Two studies of college attendance behavior—one by Jaffe and Adams, the other by Campbell and Siegel[43]—support the view that further increases in postsecondary enrollment rates will only marginally benefit universities. In both studies, it was shown that the proportion of high school graduates who enter 4-year colleges and universities has not changed significantly since the early years of the century; only the 2-year colleges would seem to be benefiting significantly from the upward trend in the overall rate of college attendance. Thus, the evidence supports a pessimistic outlook on the share of enrollment growth that universities will be able to capture in the foreseeable future.

The corollary likelihood is that the trend toward universalization of postsecondary education will do little to stimulate the demand for graduate training. Ph.D.'s constitute less than 20 percent of the instructional staffs at 2-year institutions, and this weak representation may indicate that the products of traditional graduate education simply do not fit the requirements for faculty at these less traditional institutions. Graduate faculties effectively recreate themselves; and, just as the university itself may decline in importance at the margin, so the research orientation created by conventional graduate education may be inappropriate to the needs of the newer types of institutions and students in the postsecondary educational system.

Clearly, these expanding sectors will require some kind of trained staff, and unlike the university, they will probably be unable to supply this training internally. Whether existing graduate institutions and conventional graduate programs can adapt to meet these training needs is uncertain, and will be further considered below.

[43] A. J. Jaffe and Walter Adams, "Trends in College Enrollment," *College Board Review* (Winter 1964–65), pp. 27–32; Robert Campbell and Barry N. Siegel, "The Demand for Higher Education in the United States, 1919–1964," *American Economic Review* 57 (June 1967), pp. 482–494.

Increased Flexibility in Postsecondary Education

The factor that links graduate and prebaccalaureate education is interdependency in production, with graduate students serving as inputs into undergraduate education, a relation which forms an integral part of the graduate education process. Increasingly, however, the nature of undergraduate education is being subjected to searching criticism and experimental reform.

The pressures for innovation in prebaccalaureate education are related to the striving for universalization. A major barrier to college attendance—the greatest cost incurred by the student—is the earnings he loses while attending college. Taken in conjunction with the lower consumption value that education has for low-income families (both parents and children) and with their limited access to capital markets (the children of the rich can borrow through the family[44]), foregone income is one of the most significant factors that explains why persons from lower socioeconomic classes are less likely to attend college than are the more affluent.

It may, however, be possible to reduce this cost through some form of "nonexclusive" or noncampus mode of undergraduate education, e.g., part-time enrollment, external degree programs, and such devices as televised lectures and programmed learning. The British "open university" and New York State's "university without walls" exemplify experiments in this direction. Whatever their form, these developments rely less on direct, continuing contact with faculty and on resident attendance and more on the independence of the student. Parenthetically, these developments also respond to the growing demand of the large core of middle-class students for "personal relevance" in education. But regardless of their guise or motivation, these proliferating programs represent a serious break in the traditional interconnection between graduate and undergraduate education.

Another source of current dissatisfaction with conventional undergraduate education is the continual *relative* increase in cost. As has often been pointed out (for example, by O'Neill[45]), the major input into higher

[44] For all practical purposes, children from wealthier families have virtually unlimited access to capital, even when conventional sources of credit for educational purposes are nonexistent. The student can borrow either from or through his parents, who have significant borrowing power even when their income level is modest, e.g., they may remortgage a home or take loans against life insurance. Such intrafamily transactions are not necessarily pure parent–child transfers (gifts) but rather loans from the parent to the child or even loans against the future inheritance of the child. The point is that credit for education is much more readily available to most students than is commonly recognized. I owe my recognition of this fact to conversations with Merton J. Peck.

[45] June O'Neill, *Resource Use in Higher Education* (Berkeley, Calif.: Carnegie Commission on Higher Education, 1971).

education, apart from the student's time, is the time and effort of the faculty. Thus, while the gross student–faculty ratio ("productivity") shows little sign of increasing, faculty salaries rise as income and productivity in the rest of the economy increase, leading to secular increases in the relative cost of education. As long as higher education clings to the "conventional technology," this process of real cost increase will continue. This situation adds further impetus to experimental developments of the type outlined above, with similar implications.[46]

Concomitantly, as the lockstep pattern of prebaccalaureate education is broken, postbaccalaureate education will probably become more flexible, at the expense of conventional graduate education. Such developments will be particularly likely if, as can be expected, relative net graduate tuition rises. These new postbaccalaureate opportunities might include graduate-level training in conjunction with newly developing or expanding occupations and work environments, particularly in the "applied technology" service industries, in such fields as communications, urban planning, housing, and transportation. Carried far enough, these developments could significantly reduce the "foregone earnings" cost of graduate education. As a significant example, the Rand Corporation and Arthur D. Little Co. recently have initiated programs that explicitly combine graduate-level education with research and development activities outside the university. Of course, programs of this type involve a change only in degree, since the university has traditionally relied on qualitatively similar interdependencies to reduce the cost of graduate training. With other changes in education and research, however, the university's capacity to exploit these interdependencies may be significantly eroded, thus stimulating the evolution of new institutional mechanisms for relating graduate education and research.

A Shift from Basic to Applied and Developmental Research

Another stimulus to developing extrauniversity modes of graduate-level training is the beginning of a shift from basic to applied and developmental research. Traditionally, the proportion of basic research carried out by the university has greatly exceeded its proportion of total research activity. As noted in the preceding section, the college and university share of total

[46] For a more thorough discussion of these issues, see Stephen P. Dresch, "Blindered Economics: Higher Education and Public Policy," in *Does College Matter? Some Evidence on the Impacts of Higher Education*, ed. Lewis C. Solmon and Paul J. Taubman (New York: Academic Press, 1973); and Stephen P. Dresch, "U.S. Public Policy and the Evolutionary Adaptability of Post-Secondary Education," Yale Higher Education Research Project Report #2, a discussion comment prepared for the Conference on Recurrent Education, sponsored by the Organization for Economic Cooperation and Development, Department of Health, Education and Welfare, and the Public Services Laboratory of Georgetown University, Washington, D.C., March 21, 1973.

research and development expenditure increased from 6.4 percent in 1953 to 11 percent in 1972. As a result, the growth of academic research over this period was significantly greater than that of total research and development, 12.3 percent versus 9.3 percent, respectively. However, as indicated by Table 8, this increased share and more rapid growth are entirely explained by (*a*) the higher than average growth of basic research expenditure over the period (11.9 percent) and (*b*) the universities' capacity to increase their share of basic research from 35 percent in 1953 to 57 percent in 1971. Simultaneously, the universities' share of applied research declined from 11 percent to 9 percent. Thus, the university has become increasingly dependent upon basic research, with an increase in basic research relative to total university research from 52 percent in 1953 to 77 percent in 1972.

In view of these facts, trends in research emphasis have enormous import for universities, and specifically for their ability to supply graduate education to their students. It is estimated that the basic research share of total research declined from 15.1 percent in 1971 to 14.7 percent in 1972, the first decline of more than 0.1 percent since 1956.[47] If true, and if, as the informal evidence suggests, this decline marks the beginning of a trend that will continue into the indefinite future, then university research must either be reoriented *and* reorganized or the share of total research activity carried out by the university will suffer a long-term decline.

If total research activity were expanding rapidly enough, the latter possibility might not be so threatening. But for the same reason that a shift toward applied research seems to be under way, we can expect that total research activity will decline, at least in price- (wage-) adjusted terms. Since the annual growth rate in total research expenditure (in nominal dollars), which ranged between 6 percent and 35 percent over the period 1953 to 1968, was only 4.1 percent in 1969 and 0.4 percent in 1970, this prediction is given added weight. Estimated 1971 and 1972 rates of 2.1 percent and 4.3 percent, respectively, even if confirmed, would signify significant declines after adjustment for price increases. Thus, not only is the universities' share of total research likely to decline, but total research expenditure itself is unlikely to grow at rates even approximating those of the 1950's and 1960's. The universities' ability to offer graduate education is adversely affected on both counts.

Either new graduate-level training opportunities outside of the university must be opened up, or the university must develop new modes of research, the cardinal feature of which—in contrast to conventional university research—will probably be a greater emphasis on more institutionalized, group research efforts. In addition, the usual ranking of graduate programs on a unidimensional index of quality is likely to be superceded by a system of qualitative differentiation in the very nature of the graduate programs and

[47] Declines of 0.1 percent in the basic research share were registered in 1957 and 1969.

TABLE 8 Composition of Research and Development Expenditure

Year	Basic Research			University Basic Research			Applied Research			University Applied Research		
	Total ($ million)	As % of all R & D	Growth Rate (%)	Amount ($ million)	% of Total	Growth Rate (%)	Total ($ million)	As % of all R & D	Growth Rate (%)	Amount ($ million)	% of Total	Growth Rate (%)
1953	489	9.4		173	35.4		1317	25.3		146	11.1	
			11.5			17.0			7.6			3.0
1955	608	9.7		237	39.0		1525	24.3		155	10.2	
			18.7			19.2			26.2			4.4
1957	857	8.7		337	39.3		2429	24.5		169	7.0	
			15.7			19.6			8.4			8.4
1960	1326	9.7		576	43.4		3093	22.5		215	7.0	
			16.4			19.8			8.0			10.0
1965	2853	14.0		1419	49.7		4537	22.2		346	7.6	
			8.6			12.2			5.4			14.5
1967	3363	14.2		1785	53.1		5041	21.3		454	9.0	
			5.3			7.0			5.0			5.1
1970	3921	14.9		2185	55.7		5833	22.2		527	9.0	
			2.5			3.4			4.6			3.5
1972	4120	14.7		2335	56.7		6380	22.8		565	8.9	
1957–1967			14.7			18.1			7.6			10.4
1967–1972			4.1			5.5			4.8			4.5
1953–1972			11.9			14.7			8.7			7.4

TABLE 8 Composition of Research and Development Expenditure (Con't.)

	Development						Composition of University R & D (%)			R & D Growth Rates (%)	
				University Development							
Year	Total ($ million)	As % of all R & D	Growth Rate (%)	Amount ($ million)	% of Total	Growth Rate (%)	Basic	Applied	Development	University	Total
1953	3401	65.3		15	0.4		51.8	43.7	4.5		
			10.4			6.5				10.7	9.8
1955	4146	66.0		17	0.4		57.9	37.9	4.2		
			26.4			21.3				13.9	25.6
1957	6626	66.8		25	0.4		63.5	31.8	4.7		
			12.0			10.8				15.8	11.4
1960	9311	67.8		34	0.4		69.8	26.1	4.1		
			7.0			10.9				17.2	8.3
1965	13049	63.8		57	0.4		77.9	19.0	3.1		
			8.1			25.7				13.1	7.6
1967	15238	64.4		90	0.6		76.6	19.5	3.9		
			2.8			17.0				7.0	3.6
1970	16533	62.9		144	0.9		76.5	18.5	5.0		
			2.9			2.1				3.3	3.2
1972	17500	62.5		150	0.9		76.6	18.5	4.9		
1957–1967			8.7			13.7				15.9	9.1
1967–1972			2.8			10.8				5.5	3.4
1953–1972			9.0			12.9				12.3	9.3

SOURCE: National Science Foundation, *National Patterns*, pp. 24–31.

research carried on at different levels of the system. That is, today's highest-quality research universities will probably continue to engage primarily in basic research of a traditional sort, while less prestigious institutions, instead of offering second-rate variants of "elitist" programs, will tend to specialize in applied and developmental research and related graduate education programs.

ALTERNATIVE STRATEGIES FOR GRADUATE EDUCATION

The major factors now operating on the university are, thus, (*a*) a declining share of undergraduate enrollments, (*b*) a concomitant increase in the diversity of faculty required by the broader postsecondary educational system, and (*c*) a shift of research from the basic type, where the university had a comparative advantage, to the applied type, where traditionally its standing has been relatively low. These considerations suggest two polar strategies that graduate education might pursue. The first might be termed the *enclave strategy*. That is, graduate education might attempt to shore up and maintain its present character and structure. The second might be termed the *decontrol strategy*, or "letting many flowers bloom." That is, graduate education might attempt to adapt itself to the evolving opportunities implicit in the changing circumstances described above.

Enclave Strategy

The cardinal characteristic of this strategy is the attempt to perpetuate the current structure, form, and content of graduate training. Relying on the historical interrelationships between graduate education, on the one hand, and undergraduate education and basic research, on the other, the graduate education sector would continue to focus on the preparation of research faculty.

In view of the probable contractions in basic research and in the universities' share of undergraduate enrollments, this strategy would entail a contraction in both the demand for and the universities' capacity to supply graduate education. If the universities' refusal to adapt to changed circumstances did *not* stimulate the creation of extrauniversity forms of postbaccalaureate training, or if these developments could be precluded (by control of institutional accreditation and by licensing and similar occupational controls arbitrarily requiring university training), it is likely that supply would contract significantly more than demand. As a result, this strategy would probably lead to substantial increases in net graduate tuition.

With such increases, and in the absence of major increases in external subsidies, graduate programs would probably suffer major contractions. But

these contractions would not be evenly distributed over the graduate education system. First, for the same reasons that the aggregate university share of undergraduate enrollments is likely to decline, this decline will probably be greater at the more elitist institutions. The attrition rates of entrants into 2-year colleges are notoriously high, but those who do survive the process and continue to complete baccalaureate programs are more likely to do so in less prestigious local institutions. And if survival rates at 2-year colleges should significantly increase, then recipient 4-year institutions might find their upper-division enrollments markedly swelled. In these circumstances, the capacity of "lower quality" universities to provide graduate training would increase relative to the elite institutions.

Second, changes in the demand for the graduate-educated—even if they did not lead to significant modifications in the nature of graduate training, either within or outside of universities—would also affect most seriously the demand for what has traditionally been considered "high-quality" graduate education. The demand for the graduate-trained is likely to decline least, or increase most, in 2-year colleges and in applied research and technology industries. The person with a degree from a non-elite university is probably highly substitutable for the individual educated in an elite institution in both these sectors. Consequently, the wages of Ph.D.'s from the more elite institutions, as they enter these sectors, would be held below what they otherwise might have been, whereas the wages of graduates of less prestigious institutions, already entering these markets, would be only marginally affected. Hence, the demand for higher-quality training will be more depressed than that for lower-quality training. As a result of shifts in both supply and demand, then, the center of gravity in graduate education would shift from the higher- to the lower-quality end of the spectrum.[48]

In brief, the probable consequences of an enclave strategy are increases in tuition (and certainly in costs), declines in the scale of graduate programs, and an erosion of quality. The predictable university response to all three of these consequences would be major pressure for large-scale subsidy programs. Such programs would be advocated to stimulate demand, lighten the student's burden of increased tuition, and lessen the degree of qualitative erosion.

However, just as changes in career opportunities would most severely reduce student demand for higher-quality graduate education, so student demand at lower-quality institutions would be most responsive to subsidies: thus, portable subsidies to students might not confer many benefits to

[48] The Newman *Report on Graduate Education* observes a tendency toward this deterioration in quality in the current period, but the observation may be based on miscomprehension of changes in graduate education that would be implied by a decontrol strategy, phenomena considerably more complex than a simple decline in quality.

higher-quality institutions. Any serious effort to alleviate a general decline in quality would almost necessarily require support distributed through graduate institutions, e.g., along the lines of existing trainee, internship, or training grant programs.

The latter development might be viewed as an effective method of counteracting the consequences of a decline in university teaching and research. It might well have this effect on enrollment. More fundamentally, however, a major change in the nature of the graduate education process itself is implied. With graduate students doing less teaching and participating less in research, graduate education would lose even further its differentiation from undergraduate education: its interactive, apprenticeship component.[49]

Thus, the enclave strategy finds itself on the horns of a dilemma: *Either* levels of graduate enrollment shrink, tuitions rise, and quality declines, *or* subsidies are infused, enrollments are kept up, pressures for tuition increases are contained, quality as measured by the distribution of students over institutions is maintained, but the nature of the graduate education process is significantly (and possibly adversely) altered.

Decontrol Strategy

Under the enclave strategy, the higher education system would be prevented, by collusive actions of institutions and government, from making any significant response to the changed circumstances surrounding graduate education. The polar alternative is to allow different levels of the system to respond freely to new and evolving opportunities; hence the term *decontrol*.[50] In contrast to the enclave approach, a decontrol strategy would try to *exploit* the changing composition of research and development activity and the undergraduate population, modifying the graduate training process to accommodate these changes. The existing "quality hierarchy" of graduate education would be superceded by a qualitatively differentiated system, in which institutions at different levels would exploit basically different opportunities and resources, thus fulfilling different social demands. In general, the issue of "qualitative erosion" would fade.

[49] Given the continued high rates of growth in graduate enrollment, along with the stability (since 1968 or 1969) in undergraduate enrollment and research activity, this change in the nature of graduate education may already have occurred to some extent; the question is interesting and important but as yet unexplored.

[50] Robert Hartma, of the Brookings Institution has suggested a third strategy, *harmonious euthanasia*, which he defines as: "Let the goddamn costs and prices rise and end up with a smaller, but viable, graduate sector." In fact, I would argue, the decontrol strategy is simply a more fleshed-out version of "harmonious euthanasia." His description (contained in personal correspondence with the author) is, however, succinct.

The enclave strategy might well lead to the rechanneling of a significant fraction of total postbaccalaureate enrollments from the traditional graduate education system and into extrauniversity substitutes. This tendency would be mitigated under a decontrol strategy as graduate institutions modified the structure and content of graduate programs in order to compete effectively with these extrauniversity alternatives for postbaccalaureate training.

Newly evolving opportunities cannot be clearly identified at present, so it is difficult to predict what structure the graduate education system might take. Several elements can, however, be discerned. As the lower echelons of the system turned increasingly toward highly applied, developmental, and planning activities, research and planning institutes would proliferate. Because of the connection between these and traditionally more basic university research, university-related institutes would be sufficiently competitive with alternative nonuniversity suppliers of these services as to win a significant share of this research market. This competitive advantage would be enhanced by the universities' linking these quasi-research activities with graduate training, in which they have a definite advantage over extrauniversity training.

While the emphasis on applied research and planning activities would probably be greatest at the lower levels of the system, the implied qualitative ordering would not represent a strict parallel to the present ranking of graduate institutions. Since basic and applied research activities are interconnected, applied research efforts would also develop within the more elitist institutions. Thus, a qualitative differentiation within the applied research domain might evolve, mitigating somewhat the contraction of the higher-quality institutions that would otherwise occur, given recent trends in support for basic research.

Similarly, with respect to graduate education's role in preparing faculty, a decontrol policy would probably lead to greater interaction between lower levels of the graduate school hierarchy and the rapidly expanding sectors of undergraduate education. While the elite universities would continue to emphasize conventional research faculty as the product of graduate education, the less prestigious would shift their emphasis toward a relation between applied technologies, on the one hand, and the less general, less liberal-arts nature of the more rapidly expanding prebaccalaureate programs. Thus, under a decontrol strategy, the potentially deleterious effects on graduate education of a shift of undergraduate enrollments away from the university might be avoided to some extent, since the demand for university-level graduate training would be increased at it evolved to meet the needs of the more rapidly expanding components of the postsecondary educational system. Given the development of formal or informal relations between universities and 2-year institutions, the traditional linkage between

graduate and undergraduate education—the teaching apprenticeship—could be maintained, reducing the net incremental cost of any level of graduate enrollment.[51]

[51] Roger Bolton has pointed out that the development of more closely integrated statewide systems of postsecondary education, in which the programs of technical institutes, 2-year and 4-year colleges, and universities are systematically coordinated, would lead naturally to development of the sort anticipated in the text.

5 Implications for the Financial Support of Graduate Education

The preceding discussion, although not dealing explicitly with public policy and support of graduate education, has an important bearing on these issues —issues that cannot be discussed apart from the broader perspective presented. The purpose of this final chapter is to identify explicitly what the foregoing analysis implies with respect to the financial support of graduate education.

The thrust of this discussion is that graduate education cannot be viewed in isolation but must be looked at within the context of the university's interdependent activities. Graduate education is not a commodity produced simply by combining different inputs—e.g., student and faculty time—in specifiable proportions. It is, rather, the product of complex interactions within the university. The university's capacity to supply opportunities for graduate education is a function of the level of its undergraduate teaching and its research activities. The particular structure of these activities, together with the size of graduate programs, determines the basic character of the graduate education experience. This qualitative dimension is a major determinant of student demands for graduate education, in light of posteducational career opportunities.

In short, a complex system of trade-offs exists involving potential students and graduate institutions directly and potential employers and the rest of society indirectly. The choices that universities and students make from among available options—as influenced by external incentives and pressures—define the ultimate character of graduate education and the effectiveness of the system in performing its social functions.

This summary description has one particularly fundamental implication: The numerous interdependencies in the system render hard-and-fast rules and prescriptions—particularly those externally imposed—both difficult and potentially counterproductive. Ultimately, the processes of graduate education should be responsive to a changing environment, i.e., to changes in the capacity of universities and other institutions to provide alternative forms of postbaccalaureate training and in social demands for knowledge and expertise. Effective responses are more likely if universities and students have strong incentives to adapt their programs and behavior rather than relying on policies which reward a perpetuation of the status quo. Graduate education must be particularly responsive to the evolution of undergraduate education and research, since these are the most important components of the environment and the primary determinants of the incremental cost of graduate training.

How the benefits accruing to undergraduate teaching and research should be translated into financial support for graduate education is a fundamental question. In principle, the magnitude of these benefits can be determined. The contribution of graduate programs is simply the increase in cost that would occur were either undergraduate education or research to be pursued independently of graduate education. At the margin that contribution is the reduction in cost that results from adding one graduate student. The net incremental cost of graduate education is, then, the direct cost of training this additional graduate student, less the marginal benefits to other university programs.

In these terms, net incremental cost may vary widely over time and over fields of study. Assuming that the policy objective is *not* to maintain a static structure of graduate education, actual net tuition levels should vary accordingly. This position has two primary justifications. First, potential students, employers, and society should assess the benefits of any particular type of graduate education relative to the actual resources required to provide that education. Second, if choices among fields of study or between graduate education and other training options are not guided by relevant prices, then nonprice forms of rationing will evolve. Particularly in a dynamic situation—where individual and social demands for different forms of education and training are changing significantly—a reliance on nonprice rationing will tend to insulate the graduate education sector from pressures for change, a situation that may prove both socially costly and damaging to graduate education itself.

The normative argument that graduate tuitions should equal the net incremental cost of graduate education assumes, however, that the intra-university benefits of alternative graduate programs can be quantified. That such benefits may be indirect and difficult to trace does not invalidate their pertinence to tuition policy. For example, adding a graduate program in

music may so enhance the amenity value of a position at a particular university that the salaries required to attract other faculty can be reduced. In principle, such benefits should be recognized in determining net tuition charges.

These indirect benefits are particularly relevant in assessing what graduate programs contribute to university research. It might be argued that only those graduate students directly participating in a particular research effort, e.g., as research assistants, contribute to that effort. But this simplistic argument ignores the benefits flowing from faculty interaction with students and with other faculty, possibly in very different fields, as well as the possibility that more productive research faculty would be available at lower salaries if larger or more diverse graduate programs were offered.

Parenthetically, such indirect contributions suggest that the existing pattern of support for university research may be especially suboptimal, resulting in graduate education's subsidizing research. University research is usually financed by grants which cover only the direct costs of the required resources, plus a negotiated overhead charge. While overhead rates may often be inflated (relative to actual administrative costs), direct costs understate the flow of university resources to research. None of those indirect contributions mentioned above would be considered under usual funding practice. Subject to the limitation that the cost of a particular research effort in a university should not exceed its cost were it done outside the university, research funding should take into account the indirect contributions of graduate (and even undergraduate) programs. Correspondingly, the flow of indirect benefits should be taken into account in decisions about the intrauniversity distribution of this increase in research funding.

Similar considerations apply in assessing the benefits to undergraduate education that flow from the presence of graduate programs. Again, the most simplistic assessment would include only the direct contribution of graduate students to undergraduate instruction, and even here the costs are often attributed to graduate rather than undergraduate education. In university accounting, for example, stipends to teaching assistants are often regarded as graduate financial aid rather than as a cost of undergraduate instruction. And even if direct stipends are correctly allocated, severe distortions may remain if any significant fraction of total compensation takes the form of fellowship support in nonteaching years.

More generally, the quality of undergraduate education benefits from, or is at least altered by, the presence of graduate programs on a campus. It has been commonly argued that a strong graduate program attracts a high-quality faculty to an institution, and undergraduates get at least part of this benefit. More directly, the diversity of course offerings and the opportunity to pursue more advanced prebaccalaureate work in a particular field are greater in graduate institutions. Similarly, combined (bachelor's–master's)

degree programs become feasible in universities, reducing the time required to get an advanced degree. For all these reasons, the value of graduate programs to prebaccalaureate education should be explicitly recognized in the allocation of nominal graduate program costs.

Because of the number and complexity of the interrelationships between graduate education and other university activities, firm judgments about the legitimacy of any particular structure of net graduate tuitions are difficult to render. Clearly, net tuition has varied over time and over fields and such variations, in principle, represent desirable responses by graduate institutions to changes in demands for alternative university services. If graduate institutions were subject to sufficient competitive constraints, both internally and vis-à-vis alternative suppliers of university services (2- and 4-year colleges and nonuniversity research organizations), the subordination of the individual institution to the "discipline of the market" could be expected to result in a desirable allocation of social resources to these various activities. In fact, of course, obvious barriers—taking such forms as interinstitutional collusion and accreditation—prevent the free functioning of the higher education and related markets. Nonetheless, the nature of their activities suggests that the sector's performance would be more effectively improved by relying on incentives that will induce institutions to adjust to evolving circumstances than by attempting to impose particular types of adjustment.

Thus, if graduate education is effectively integrated with other university activities, its contribution to them should generally be great enough to defray a significant part of the direct costs of graduate education. These reductions in cost do not imply a subsidization of graduate students by the university. However, in particular fields and circumstances, the costs of graduate training are still quite high; even on the average the costs, including foregone earnings, will be positive. Thus, the issue of how these costs are to be met must be addressed.

The discussion in Chapter 2 leads to a questioning of the justification for large-scale subsidies to graduate education. Apart from need-based grants justified on equity–efficiency grounds (the failure of students from certain socioeconomic backgrounds to perceive the future benefits of graduate training), the appropriate target of subsidy policy is, in general, the post-educational career activity of the graduate-educated rather than graduate education *per se*. In the interest of efficiently utilizing skilled manpower and of dynamically developing such manpower, subsidies should be tied directly to those activities which society values rather than to specific, high-skill labor inputs into those activities.

As discussed in Chapter 2, in the absence of any compelling rationale for across-the-board subsidization of graduate education, potential students' access to capital markets must be improved and means for insuring against the risks of graduate education must be developed. The availability of

credit for financing investments in human capital is limited, and this limitation constitutes a severe barrier to the efficient allocation of resources to education. More seriously, students from less wealthy families suffer most from capital market imperfections. As indicated in Chapter 4, even in the absence of explicitly educational credit, higher-income students can tap capital markets indirectly, through their families. The low-income student whose parents can offer no collateral finds the capital market virtually closed to him as a means of financing his education. The Appendix to this monograph outlines specific proposals for improving capital markets and providing the student with insurance against the risks of the decision to pursue a career requiring graduate education. These include lengthening the term of repayment of educational loans, gearing repayment to anticipated changes in the borrower's ability to repay, and pooling risks by combining borrowers into repayment cohorts with the individual's repayment contingent on his relative income experience.

In summary, if graduate institutions can respond flexibly and effectively to a changing external environment, graduate education will benefit financially. Tuitions reflecting the opportunity costs of graduate education in this evolving context will serve as appropriate guides to the educational decisions of individuals. Improvements in capital and insurance markets should then lead to socially desirable choices among alternative educational-career options.

Appendix: Capital and Insurance Markets and Investment in Graduate Education

As has been noted at several points in the preceding discussion, imperfections in capital and insurance markets represent potentially serious barriers to the efficient allocation of resources to graduate education. This Appendix proposes specific improvements in these dimensions, focusing on capital and insurance markets in turn.

IMPROVING CAPITAL MARKETS

For further obvious reasons, conventional sources of credit for investment are virtually foreclosed to the investor in education. Even those student loan programs developed by the government or under government sponsorship are grossly inadequate. In effect, credit for human capital investments corresponds much more closely to consumer than to investment credit. First, the level of borrowing permitted is too low for those pursuing lengthy and expensive educational programs. Second, the terms of repayment are unduly restricted, usually limited to the first 10 years after degree completion: the lowest income phase of the former student's earning lifetime as well as the period when he possibly faces the heaviest financial demands imposed by marriage and family formation.

But the financial return to postbaccalaureate education is distributed over the entire earning lifetime. Indeed, compared to those persons in lower-

level occupations (whose earnings reach a plateau at an early age), the more highly educated usually start out making lower wages but earn more as they grow older. Thus, educational investments concentrate income at later ages, whereas existing educational credit requires the discharge of debt in the earliest, lowest-earning phase of the life cycle.

The first step in improving capital market access is, then, simultaneously to increase the permissible level of borrowing and to provide at least the option for a more desirably timed debt repayment. Periods of 20 to 30 years would not seem excessive for educational debts of, for example, $10,000 to $20,000 (1973 dollars). Further, the requirement that such debt be amortized in equal annual installments should be modified to permit the profile of repayment to correspond at least roughly to the profile of anticipated earnings.[52] In a noninflationary world, a schedule of repayments increasing at a rate of between 5 percent and 7 percent per year is implied. That is, annual payments at the end of the period should be about three times as large, in constant dollars, as early-year installments, an increase corresponding to the expected tripling of a college graduate's real annual income over a 20-year period.

To digress momentarily: Two fundamental problems are connected with educational loan proposals. First, existing federally sponsored programs incorporate significant explicit or implicit subsidies. The National Defense Education Act (NDEA) loans are offered at the highly subsidized interest rate of 3 percent, with no interest accrual during the period of educational enrollment. Although entailing a higher interest charge (7 percent), the Guaranteed Loan Program (GLP) provides an interest subsidy to lenders (varying with credit market conditions) as well, subsidizing all interest for lower-income student borrowers during periods when they are enrolled in school. Thus, the question arises: Should an expanded loan program directed at graduate education also incorporate significant subsidies? In general, the answer would seem to be no. If it is desirable to subsidize graduate (or any other) education, the student's willingness to borrow should not be a condition for receipt of that subsidy. The student who, for whatever reason, prefers to avoid debt—drawing instead on family resources or on wages from part-time employment—should not be deprived of subsidies made available to those who prefer to utilize loans. Even if the subsidy is to be dis-

[52] To be entirely consistent with the borrower's desired lifetime pattern of consumption expenditure, debt retirement should be keyed to the profile of *savings* rather than income. However, after leaving school additional sources of credit, e.g., home mortgages, become available that were foreclosed during the years of schooling, permitting the former student to compensate, within limits, for excessively rapid repayment of educational loans. Thus, income would appear to serve as a sufficiently close proxy for a desired time profile of debt repayment.

tributed on the basis of need, there are more equitable measures of need than willingness to borrow. In fact, experience under existing federal programs indicates that willingness to borrow is a particularly bad indicator of need, with the benefits of loan subsidies accruing disproportionately to middle- and upper-income students.[53]

Second, the supply of funds to student loan programs represents a problem that has not yet been satisfactorily resolved. The NDEA loans were capitalized by federal appropriations, making them seem disproportionately costly compared with the privately funded GLP. For this and other reasons, federal guarantees of privately funded loans have been increasingly relied on, with the unfortunate side effect that the supply of funds to the student loan market is cyclically unstable, subject to recurrent credit crunches in periods of high interest rates. Because interest rates charged on guaranteed loans are limited by law, banks and other private lenders have not provided adequate funds in periods when money is tight, and federal augmentation of student interest rates has not been sufficient to ensure that educational loans will be available.

If credit availability represents a serious problem for existing programs, the problem is magnified in the case of much longer-term loans. Even when the repayment period has been limited to 10 years, private sources, anticipating future increases in interest rates, have withdrawn funds from the student loan market. The supply of funds to longer-term programs would be even more unstable.

Clearly, the demand for funds could be met if interest rates were permitted to fluctuate with market conditions. But, in this event, a student could easily be saddled with a long-term, high-interest-rate commitment, which he might find particularly onerous to discharge if interest rates and the rates of inflation and income growth subsequently declined. The obvious alternative to fixed, potentially excessive interest rates is to finance student loans on a relatively short-term basis, and correspondingly to incorporate a variable interest charge in the student's loan agreement. This might be done in a number of ways. Perhaps the simplest would involve a graduated schedule of repayments that would discharge the student's loan in, for example, 20 years at the mean anticipated interest rate. Should actual interest rates be lower than anticipated, the debt would be paid off earlier; if higher, repayment would continue beyond the 20 years.[54] Given the relation between interest rates and the rate of nominal income growth, this technique would

[53] Robert W. Hartman, *Credit for College: Public Policy for Student Loans* (New York: McGraw-Hill, 1971).

[54] This technique, combining a fixed repayment schedule with a variable interest rate, and resulting in a loan of *ex ante* indeterminate term, has been commonly employed in variable interest rate mortgage loans, particularly in Western European countries.

protect the student from repayment commitments grossly out of line with his expected ability to pay.

Thus, the first step in increasing the ability of students to finance graduate education is to improve access to capital markets. Loan terms should be modified to permit longer periods of repayment and to gear repayment terms to anticipated income growth. Interest rates on both new and existing loans should vary with credit conditions, thus ensuring adequate capital supplies without undue risks to borrowers. In general, such loans should not be subsidized; the benefit of any subsidy should not depend on willingness to borrow. This prohibition of subsidization would apply not only to interest rates but also to mortality and default insurance.

INSURING AGAINST THE RISKS OF GRADUATE EDUCATION

The above reference to default immediately suggests why the private capital market has not provided adequate funds and desirable credit terms for investments in education.[55] The reason is simple: Unlike investments in physical capital (e.g., machines), investments in human capital entail significant risks. The borrower's only asset is his future income; and given prohibitions against involuntary servitude, this asset cannot be attached or repossessed by the lender should the borrower default.

A large-scale loan program can eliminate much of this risk by pooling it over a large number of borrowers. Thus, interest charges to all borrowers could be raised sufficiently to compensate the lender for the losses incurred on the few who default. All borrowers would, in effect, insure themselves against default. The one obvious difficulty with such insurance is that the risk may, by its nature, be uninsurable, i.e., the conditions that lead one person to default may lead large numbers of others to do the same. If national economic conditions are related to default, then in a recessionary period a very high proportion of borrowers will default, whereas a very low proportion will default in an expansionary period. Such extreme outcomes are particularly likely under a system of long terms combined with fixed, potentially onerous (relative to income growth) interest rates. Hedging against this risk might lead to charging excessive risk premium increments incorporated in interest rates, and these could even serve to stimulate default, thus creating a self-fulfilling prophesy.

Another variant of this insurance problem is "moral hazard," the possibility that borrowers will purposely default. Immediately after they leave school, students may find the cost of bankruptcy very low, since their in-

[55] Mortality does not constitute much of a risk since the lender can require that the borrower be insured for the amount of the outstanding debt.

comes are relatively low, and wealth has not yet been accumulated. In these circumstances, the borrower may be greatly tempted to default on student loans and declare bankruptcy, particularly if the accumulated debt is sufficiently high.

Even if the difficulty of lender risk could be resolved, the serious problem of risk to the borrower would remain. In the discussion of labor supply (Chapter 2, pp. 13ff), it was stated that two types of risk affect the student's evaluation of the return to graduate education: individual risk and market risk. Individual risk derives from the student's uncertainty about his academic success in a particular field and his ultimate financial success relative to that of his peers. He cannot with precision foretell where he will fall in the distribution of possible future incomes.

The matter of individual risk is a source of concern because it is felt that students in general are risk-averse, i.e., that they prefer lower but certain returns to higher but uncertain returns. If this characteristic is indeed a fact, then the student's risk-aversion will lead him to invest less than is desirable in graduate education. The obvious solution to the problem of risk aversion is to develop some form of risk pooling, since the expected payoff to a cohort of students with similar expectations is more certain than the expected payoff to the individual.

Moral hazard again intrudes, limiting the extent to which the pecuniary benefit of graduate education can be insured. If 100 percent of a student's expected income were guaranteed by the insurance pool, he would have little incentive to work hard for a high income. The "insurance premium" would absorb all income in excess of the guaranteed amount, in effect imposing a 100 percent tax on all income above that level. Under these arrangements, one can easily imagine the entire class of insured persons attempting to collect. This is precisely what is meant by moral hazard. The very fact of insurance leads to behavior which alters the individual's probability of collecting.

The solution to the moral hazard dilemma—here as in other forms of insurance—is to impose some form of coinsurance, i.e., to insure only some fraction of any loss. Thus, instead of insuring that income will not be less than its expected value, some fraction of income could be guaranteed not to be less than a specified amount. In consequence, the incentive to collect (and the degree of insurance) would be reduced.

Limited risk pooling is precisely the function of the income contingent loan. This type of loan commits the borrower not to a fixed schedule of repayments (either constant or graduated) but to payments equal to some fraction of income per unit (e.g., $1,000) borrowed. In effect, that fraction of income is guaranteed not to be less than the amount borrowed. In exchange for this guarantee, the borrower pays a premium, in the form either of an

initial increment to the amount owed or of a higher interest rate applied to outstanding balances.[56]

The Yale Tuition Postponement Option, available to graduate and professional students as well as to undergraduates, is an example of this type of income-insured loan. For each $1,000 borrowed, the borrower agrees to an annual payment equal to 0.4 percent of his adjusted gross income, for a period of up to 35 years. His commitment to repay ceases either when his own debt is totally retired or when the cohort of borrowers (defined as all those who initiated repayment in the same year) has retired its collective debt (cohort termination). The debt of the cohort is simply the aggregate amount advanced to its members plus accrued interest and administrative costs. The individual's debt is defined as the initial amount advanced *plus* an insurance premium equal to 50 percent of that amount. Thus, in exchange for a contingent premium of $500, the student ensures that 0.4% of income will not be less than $1,000.[57] If, at the time of cohort termination or the expiration of the maximum 35-year repayment period, the accumulated payments of the borrower were sufficient only to retire, for example, a debt of $500, the borrower would receive insurance benefits of $500, in that he would be forgiven the remaining loan balance.

Though referred to as a loan, a program such as the Tuition Postponement Option need not be restricted to those persons who desire to borrow. If the "borrower" is permitted to "reinvest" the proceeds of the loan with the lending agency, and if the interest he receives on this investment is equal to the rate at which interest is accrued on his debt, he will have reduced his participation to pure income insurance. The provisions of the Yale program approximate such a system, permitting borrowers to maintain advance payment accounts which earn interest at Yale's cost of funds, while student debt accounts accrue interest at a rate equal to the cost of funds plus a small (less than 1 percent) administrative charge.

The previous discussion of coinsurance can be made more specific through the example of the Tuition Postponement Option. A borrower

[56] For a more extensive discussion of the range of income-contingent loan structures, see D. Bruce Johnstone, with Stephen P. Dresch, *New Patterns for College Lending: Income Contingent Loans* (New York: Columbia University Press, 1972). A computer model designed to simulate the performance of any specified loan variant and identify those variants which satisfy predetermined profitability conditions is thoroughly described in Robert D. Goldberg, "The Dresch-Goldberg VTL Simulation Model" [Yale University, Research in the Economics of Higher Education, Report No. 3 (June 1, 1973), and applied in Stephen P. Dresch and Robert D. Goldberg, "Variable Term Loans for Higher Education—Analytics and Empirics," *Annals of Economic and Social Measurement* 1 (Jan. 1972)], pp. 59–92.

[57] More precisely, the student ensures that 0.4 percent of the *present* (discounted) *value* of future income will not be less than $1,000.

whose cumulative income is $250,000 would just repay his $1,000 debt. If the average income of all borrowers were $250,000, the contingent insurance premium would have to be infinite, i.e., there could be no upper limit on the amount any individual borrower repaid, and the excess amounts repaid by high income borrowers would just offset the deficit repayments of low income borrowers. In this situation, if a person were permitted to borrow $250,000 he would have no incentive to earn any income. To avoid this possibility, the program contains two restrictions. First, the amount which the individual can borrow is limited, precluding a guarantee of, and a commitment to repay, 100 percent of income. Second, the program is designed so that a person with somewhat less than the expected mean income will just retire his debt, reducing the maximum repayment liability of high-income borrowers to 150 percent of the amount borrowed. That is, the average income of the group of borrowers is expected to be greater than $250,000. Thus, an additional dollar of earnings can never be entirely absorbed by increased loan payments.

Ideally, in an insurance program of this type, a single cohort would consist only of those persons with identical income expectations. To the degree that the expectations of borrowers differ, the program involves those with higher income expectations subsidizing those with lower income expectations. Thus, if sociology Ph.D.'s expecting lifetime incomes of $155,000 (1964) were grouped with physics Ph.D.'s expecting incomes of $211,000, the borrowing physicists would, on average, subsidize the borrowing sociologists. If it is in fact desirable to subsidize sociologists, there seems to be no justification for requiring only physicists (or other borrowing graduate students) to contribute to the subsidy pool.

The grouping of potential borrowers who have systematically different income expectations raises several problems in addition to that of equity. First, those expecting high incomes may be deterred from participating because they anticipate making larger-than-average repayments. If these expectations of high income were purely subjective—i.e., had no basis apart from the psyche of the individual—there would be no cause for concern. But, if the expectations are objectively founded, then the failure of these persons to participate will reduce the relative number of high-income persons in the borrowing group and hence the average income of those who do borrow. If repayment conditions (tax rate, contingent premium, term of repayment, etc.) were determined so that the lending fund would just break even if students with high-income anticipations did borrow, then the failure of this group to participate would result in losses to the lending fund. Correspondingly, those with lower-than-average expected incomes would have a disproportionate incentive to borrow, further destroying the financial viability of the pool.

This phenomenon of *ex ante* borrower self-selection on the basis of *objective* income expectations, referred to in the literature as *adverse selection*, will arise in any situation in which diverse groups are pooled. It can be limited, however, by reducing the potential premium, and increasing the degree of coinsurance (specifically, the tax rate applied to income), thus moving toward limited, "catastrophy" insurance which would have similar value to virtually all discrete classes of borrowers.

The problem of *ex ante* adverse selection must be distinguished from the problem of moral hazard discussed above. The latter refers to the effect of the repayment features on the behavior of the borrower *after* he is a participant, while the former concerns the effects of the terms of repayment on the *composition* of the pool of borrowers, i.e., on the characteristics of actual relative-to-potential borrowers. In general, it would appear that the problem of *ex post facto* moral hazard raises more serious issues than *ex ante* adverse selection. The moral hazard rubric here can be viewed as covering a range of potential borrower responses to the particular terms of repayment, responses such as changes in marriage patterns, in patterns of labor force participation, and in levels of post-school investments in human capital. Potentially pervasive implications in these dimensions certainly deserve serious consideration in the development and evaluation of systems of income insurance, although they raise issues that cannot be adequately discussed within the confines of this Appendix.[38]

To return to the issues of *ex ante* income expectations and adverse selection, if diverse borrowers must be accommodated in a single risk pool, and the degree of available insurance must be correspondingly reduced, then the effectiveness of the program as general income insurance is reduced. Thus, its usefulness in stimulating potential students to invest in education is sacrificed for the sake of financial viability. This is the second and more serious result of a failure to divide those with significantly different income expectations into separate risk pools.

Whether differential income expectations constitute a serious problem at the graduate level is, however, an open question. Certainly the income expectations of Ph.D.'s differ significantly over fields. But, relatively few entering graduate students actually receive the Ph.D., and the expected incomes of all entrants may therefore be subject to much less systematic variation. An income-contingent loan program for graduate students would certainly become more politically feasible if it could be shown that a single plan for all fields and types of graduate institutions would conform closely enough to a system of pure insurance. Therefore, serious effort is currently

[38] These issues will be raised, but probably not resolved, in a forthcoming article by Marc Nerlove, which will incorporate a review of Johnstone, *New Patterns for College Lending*.

being devoted to assessing the income expectations of graduate students.

Income insurance of the type discussed is useful only as a means of insuring against the *individual* risks of graduate education. There remains the problem of market or social risk, the risk that, because of changes in the social demand for knowledge and expertise, the entire group of students will find themselves with much lower incomes than they expected. This risk is obviously greater at the level of the particular field of study and can be reduced somewhat by pooling different fields, either in the same program, if this is appropriate, or by using the profits of a program for one field to cover the losses of a program for another. This risk cannot be completely pooled, however, in that circumstances may reduce the financial return to all groups of the graduate-educated. For instance, pervasive anti-intellectualism and a Luddite rejection of all science and technology could create a general depression among the ranks of the highly educated.

The Yale Tuition Postponement Option insures against this possibility by incorporating a maximum repayment term significantly longer than that anticipated as necessary for cohort termination. Thus, cohorts are expected to terminate repayment after 20 years, but should incomes turn out to be significantly lower than expected, cohorts can be forced to repay for up to 35 years. This technique saddles the cohort of borrowing students with virtually the entire burden of the market risk.

An alternative to this very conservative design is to provide for "contingent subsidies" that would cover the losses sustained by a lending fund if actual incomes fell significantly below expectations. Such shortfalls would reflect essentially unpredictable changes in social values and preferences. If allocations of resources to graduate education are to be socially optimal, it should be assumed that these values and preferences will not change, and society should be prepared to insure persons against the risks of such changes. In short, a publicly supported program would be based on the best available current estimates about the financial returns to graduate education. If these estimates were realized, borrowing students would simply retire their collective debts; if, however, incomes in general were lower than anticipated, society would bear the burden of the loss.

In addition to providing income insurance, a program of this type would go far toward eliminating capital market imperfections. The risks of borrowing faced by the student would be significantly reduced by the availability of income insurance. Rather than being committed to a fixed obligation, whatever his ability to pay, the borrower would know in advance the burden of debt retirement relative to income. Similarly, the risk to the lender of default would be reduced because repayment commitments would be keyed to income. Finally, the unstable capital supply implications of fixed interest rate debt could be mitigated by the incorporation of a floating

interest rate. If interest rates and rates of income growth continue to move together, this would not pose a severe risk to either the student or the lender.[59]

In short, although capital market imperfections could be significantly reduced without the concomitant development of income insurance mechanisms, the latter would be inconceivable without the former and could provide a major impetus to efforts to improve access to capital markets for financing graduate-level educational investments.

[59] For example, under the Yale Tuition Postponement Option, an increase in the interest rate has no effect on the real (discounted) payments of any individual or on the financial viability of the fund if the rate of secular growth rises correspondingly.

NATIONAL BOARD ON GRADUATE EDUCATION PUBLICATIONS

Board Reports

1. *Graduate Education: Purposes, Problems and Potential*, November 1972, 18 pp.
2. *Doctorate Manpower Forecasts and Policy*, November 1973, 22 pp.
3. *Federal Policy Alternatives Toward Graduate Education*, March 1974, 127 pp.

Technical Reports

TR 1. *An Economic Perspective on the Evolution of Graduate Education*, by Stephen P. Dresch, March 1974, 76 pp.

TR 2. *Forecasting the Ph.D. Labor Market: Pitfalls for Policy*, by Richard Freeman and David W. Breneman, April 1974, 56 pp.

Other Publications

An Annotated Bibliography on Graduate Education, 1971-1972, October 1972, 151 pp.

"Comment" on the Newman Task Force Report on the Federal Role in Graduate Education, June 1973, 13 pp.